# User Manual

## Programming of TesiMod Operating Terminals

| | |
|---|---|
| Part Number: | 80860.026 |
| Version: | 1 |
| Date: | 02.03.2005 |
| Valid for: | TSwin 2.35 |

SÜTRON ELECTRONIC GMBH

| Version | Date | Modifications |
|---|---|---|
| 1 | 02.03.2005 | First Edition |

This manual, including all illustrations contained herein, is copyright protected. Use of this manual by any third party in departure from the copyright provision is forbidden. No part of this manual may be reproduced, translated or electronically or photographically archived or altered without the express written consent from Sütron electronic GmbH. Violations shall be cause for damage liability.
Sütron electronic reserves the right to make any changes that contribute to technical improvement.

# Overall Table of Contents


1 Important Notes ..... 1-1

1.1 Symbols ..... 1-1
1.1.1 General Symbols ..... 1-1
1.1.2 Specific Symbols ..... 1-1
1.2 Safety Notes ..... 1-2
1.3 Intended Use ..... 1-2
1.4 Target Group ..... 1-2

2 Operating Concept ..... 2-1

2.1 Introduction ..... 2-1
2.1.1 Uniform device features ..... 2-1
2.2 Programming TesiMod Operating Devices ..... 2-3
2.2.1 Hardware Prerequisites ..... 2-3
2.2.2 Installing TSwin ..... 2-4

3 Standard Mode ..... 3-1

3.1 Setting the Operating Mode ..... 3-1
3.2 Behavior of the Operating Device During Start-Up ..... 3-2
3.2.1 With Valid Project ..... 3-2
3.2.2 Without a Valid Project ..... 3-3
3.3 Communication with a Controller ..... 3-3
3.4 Masks ..... 3-4
3.4.1 Mask Structure ..... 3-4
3.4.2 Mask Parameters ..... 3-5
3.4.2.1 Mask Number ..... 3-5
3.4.2.2 Access Level ..... 3-5
3.4.2.3 Background Color ..... 3-5
3.4.2.4 Help Mask ..... 3-6
3.4.2.5 Variables Management Topdown ..... 3-6
3.4.2.6 Automatic Data Release ..... 3-6
3.4.2.7 Reset Password ..... 3-6
3.4.2.8 Activate Help Mask ..... 3-6
3.4.3 System Masks ..... 3-6
3.4.3.1 Setup Mask ..... 3-7
3.4.3.1.1 Password Protection for Setup Mask ..... 3-7
3.4.3.1.2 Suppressing the Setup Mask ..... 3-7
3.4.3.2 Start-up Mask ..... 3-7
3.4.3.3 Password Mask ..... 3-8
3.4.4 Input/Output Masks ..... 3-9
3.4.5 Help Masks ..... 3-9
3.5 Variables ..... 3-10
3.5.1 Symbolic Name ..... 3-10
3.5.2 Controller Address ..... 3-11

3.5.3 Representation Type ... 3-11
3.5.3.1 Decimal Number ... 3-11
3.5.3.1.1 Standard ... 3-11
3.5.3.1.2 Timer ... 3-12
3.5.3.1.3 Counter ... 3-15
3.5.3.1.4 BCD Format ... 3-16
3.5.3.2 Alphanumeric ... 3-17
3.5.3.3 Selection Text ... 3-18
3.5.3.4 Selection Image ... 3-19
3.5.3.5 Floating Point Number ... 3-20
3.5.3.6 Hexadecimal Number ... 3-21
3.5.3.7 Binary Number ... 3-22
3.5.3.8 Bars ... 3-23
3.5.3.9 Curve ... 3-25
3.5.3.10 Fields ... 3-26
3.5.3.10.1 Message Field ... 3-26
3.5.3.10.2 Recipe Field ... 3-27
3.5.3.10.3 Table Field ... 3-27
3.5.4 Field Type ... 3-28
3.5.4.1 Input ... 3-28
3.5.4.2 Output ... 3-28
3.5.4.3 Password ... 3-29
3.5.4.4 Cyclical ... 3-29
3.5.5 Format ... 3-29
3.5.5.1 Only Positive ... 3-29
3.5.5.2 Display Leading Zeros ... 3-29
3.5.5.3 Field Length ... 3-29
3.5.5.4 Fractional Digits ... 3-30
3.5.6 Documentation Value ... 3-30
3.5.7 Limits ... 3-30
3.5.8 Scaling ... 3-31
3.5.8.1 Scaled Input ... 3-31
3.5.8.2 Scaled Output ... 3-31
3.5.9 Communication Definition ... 3-33
3.5.9.1 PLC Handshake ... 3-33
3.5.9.2 With Enter ... 3-34
3.5.9.3 With +, –, or Enter ... 3-35
3.5.9.4 For all changes ... 3-35
3.5.10 Access Type ... 3-35
3.5.10.1 Normal ... 3-35
3.5.10.2 Selective ... 3-35
3.5.10.3 Article Administration ... 3-36
3.5.10.4 Delete Article Administration ... 3-36
3.5.11 Variable Type ... 3-36
3.5.11.1 Standard ... 3-36
3.5.11.2 Timer ... 3-36
3.5.11.3 Counter ... 3-36
3.5.11.4 BCD Number ... 3-37
3.5.12 Attributes (Static or Dynamic) ... 3-37
3.5.12.1 Global ... 3-37
3.5.12.2 Inverse ... 3-37
3.5.12.3 Flashing ... 3-38
3.5.12.4 Underline ... 3-38

3.5.12.5 Invisible ... 3-38
3.5.12.6 Non-Editable ... 3-38
3.5.13 Font ... 3-38
3.5.14 Help Mask ... 3-39
3.5.15 Output Variables ... 3-39
3.5.15.1 One-Off and Cyclical Output Variables ... 3-39
3.5.15.2 Formatted Output ... 3-40
3.5.16 Input Variables ... 3-40
3.5.16.1 Plausibility Check ... 3-41
3.5.17 System Variables ... 3-41
3.5.17.1 Basic Functions ... 3-42
3.5.17.1.1 IntEraseEprom ... 3-42
3.5.17.1.2 MainVersion ... 3-42
3.5.17.1.3 ComVersion ... 3-42
3.5.17.1.4 UserVersion ... 3-42
3.5.17.1.5 Boot ... 3-43
3.5.17.1.6 LcdContrast ... 3-43
3.5.17.1.7 LcdBackground ... 3-43
3.5.17.1.8 LcdBackLight ... 3-43
3.5.17.1.9 TurnOnTemp ... 3-44
3.5.17.1.10 OsLanguage ... 3-44
3.5.17.1.11 IdentName ... 3-44
3.5.17.1.12 IdentVersion ... 3-44
3.5.17.1.13 IdentDate ... 3-45
3.5.17.1.14 IdentTime ... 3-45
3.5.17.1.15 IdentCount ... 3-45
3.5.17.1.16 IdentRandom ... 3-45
3.5.17.1.17 ComErrorRetry ... 3-45
3.5.17.2 Communication SER1 ... 3-47
3.5.17.2.1 ComDataLenA ... 3-47
3.5.17.2.2 ComParityA ... 3-47
3.5.17.2.3 ComStopBitsA ... 3-47
3.5.17.2.4 ComBaudrateA ... 3-48
3.5.17.2.5 ComHandshakeA ... 3-48
3.5.17.2.6 ComDefaultA ... 3-48
3.5.17.2.7 ComTimeout ... 3-49
3.5.17.2.8 ComRetryTimeout ... 3-49
3.5.17.2.9 ComSlaveNr ... 3-49
3.5.17.2.10 ComErrorCode ... 3-49
3.5.17.2.11 ComErrorSubcode ... 3-50
3.5.17.3 Error Statistics SER1 ... 3-50
3.5.17.3.1 ComParityCount ... 3-50
3.5.17.3.2 ComOverrunCount ... 3-51
3.5.17.3.3 ComFrameCount ... 3-51
3.5.17.4 Communication SER2 ... 3-51
3.5.17.4.1 ComDataLenB ... 3-51
3.5.17.4.2 ComParityB ... 3-51
3.5.17.4.3 ComStopBitsB ... 3-52
3.5.17.4.4 ComBaudrateB ... 3-52
3.5.17.4.5 ComHandshakeB ... 3-52
3.5.17.4.6 ComDefaultB ... 3-52
3.5.17.5 Real-Time Clock ... 3-53
3.5.17.5.1 RTCSec ... 3-53
3.5.17.5.2 RTCMin ... 3-53
3.5.17.5.3 RTCHour ... 3-53
3.5.17.5.4 RTCDay ... 3-53

3.5.17.5.5 RTCMonth ... 3-54
3.5.17.5.6 RTCYear ... 3-54
3.5.17.5.7 RTCDayOfWeek ... 3-54
3.5.17.5.8 RTCDateFmt ... 3-54
3.5.17.5.9 RTCYear2000 ... 3-54
3.5.17.6 Serial Message System ... 3-56
3.5.17.6.1 RepmanSortCrit ... 3-56
3.5.17.6.2 ClearRepBuf ... 3-56
3.5.17.6.3 RepmanRepPrint ... 3-56
3.5.17.6.4 RepoutNr ... 3-57
3.5.17.6.5 RepoutDate ... 3-57
3.5.17.6.6 RepoutTime ... 3-57
3.5.17.6.7 RepoutAnzYear ... 3-57
3.5.17.6.8 RepoutRepText ... 3-57
3.5.17.6.9 Repout RepText21 ... 3-58
3.5.17.6.10 RepoutRepText41 ... 3-58
3.5.17.6.11 RepoutRepText61 ... 3-58
3.5.17.6.12 RepmanQuitKey ... 3-58
3.5.17.6.13 RepmanChgMask ... 3-59
3.5.17.6.14 RepoutQuitText ... 3-59
3.5.17.6.15 RepoutQuitText21 ... 3-59
3.5.17.6.16 RepoutQuitText41 ... 3-60
3.5.17.6.17 RepoutQuitText61 ... 3-60
3.5.17.6.18 RepoutQuitAnz ... 3-60
3.5.17.6.19 RepoutMarker ... 3-60
3.5.17.6.20 RepoutSelectGroup ... 3-61
3.5.17.6.21 RepoutSelectTime ... 3-61
3.5.17.6.22 RepoutGroup ... 3-61
3.5.17.7 Parallel Message System ... 3-61
3.5.17.7.1 RepmanSortCritP ... 3-61
3.5.17.7.2 RepoutNrP ... 3-62
3.5.17.7.3 RepoutDateP ... 3-62
3.5.17.7.4 RepoutTimeP ... 3-62
3.5.17.7.5 RepoutAnzYearP ... 3-62
3.5.17.7.6 RepoutRepTextP ... 3-63
3.5.17.7.7 Repout RepText21P ... 3-63
3.5.17.7.8 RepoutRepText41P ... 3-63
3.5.17.7.9 RepoutRepText61P ... 3-63
3.5.17.7.10 RepoutSelectGroupP ... 3-64
3.5.17.7.11 RepoutGroupP ... 3-64
3.5.17.8 Printer Control ... 3-64
3.5.17.8.1 StopPrint ... 3-64
3.5.17.8.2 BlockPrint ... 3-64
3.5.17.8.3 PrintAllRep ... 3-65
3.5.17.8.4 PrintAllState ... 3-65
3.5.17.8.5 BlockPrintLong ... 3-65
3.5.17.9 Menu Control / Keys ... 3-65
3.5.17.9.1 NewMask ... 3-65
3.5.17.9.2 VarTablenR0 ... 3-66
3.5.17.9.3 VarTablenR1 ... 3-66
3.5.17.9.4 HardCopy ... 3-66
3.5.17.9.5 TabLeft ... 3-66
3.5.17.9.6 TabRight ... 3-67
3.5.17.9.7 TabPgUp ... 3-67
3.5.17.9.8 TabPgDn ... 3-67
3.5.17.9.9 Shift ... 3-67
3.5.17.9.10 ShiftCase ... 3-68
3.5.17.9.11 ShiftTouch ... 3-69
3.5.17.9.12 KeyCursLeft ... 3-69

3.5.17.9.13 KeyCursRight ..... 3-69
3.5.17.9.14 KeyCursUp ..... 3-69
3.5.17.9.15 KeyCursDown ..... 3-69
3.5.17.9.16 KeyHome ..... 3-70
3.5.17.9.17 KeyHelp ..... 3-70
3.5.17.9.18 KeyDot ..... 3-70
3.5.17.9.19 KeyClear ..... 3-70
3.5.17.9.20 Key0 ..... 3-70
3.5.17.9.21 Key1 ..... 3-71
3.5.17.9.22 Key2 ..... 3-71
3.5.17.9.23 Key3 ..... 3-71
3.5.17.9.24 Key4 ..... 3-71
3.5.17.9.25 Key5 ..... 3-71
3.5.17.9.26 Key6 ..... 3-72
3.5.17.9.27 Key7 ..... 3-72
3.5.17.9.28 Key8 ..... 3-72
3.5.17.9.29 Key9 ..... 3-72
3.5.17.9.30 KeyPlus ..... 3-72
3.5.17.9.31 KeyMinus ..... 3-73
3.5.17.9.32 KeyEnter ..... 3-73
3.5.17.9.33 KeyEdit ..... 3-73
3.5.17.10 Password ..... 3-73
3.5.17.10.1 MskChgPasswd ..... 3-73
3.5.17.10.2 MskChgResPasswd ..... 3-74
3.5.17.10.3 ChangePasswd ..... 3-74
3.5.17.10.4 FlashPasswd ..... 3-74
3.5.17.10.5 PasswdInactive ..... 3-74
3.5.17.10.6 ActViewLevel ..... 3-75
3.5.17.10.7 ActEditLevel ..... 3-75
3.5.17.11 Recipes ..... 3-76
3.5.17.11.1 SelectDSNr ..... 3-76
3.5.17.11.2 SelectDSName ..... 3-76
3.5.17.11.3 DestDSNr ..... 3-76
3.5.17.11.4 DSCopy ..... 3-76
3.5.17.11.5 DSDelete ..... 3-77
3.5.17.11.6 ActDSName ..... 3-77
3.5.17.11.7 SelectRezeptNr ..... 3-77
3.5.17.11.8 SelectRezeptName ..... 3-77
3.5.17.11.9 DSDeleteState ..... 3-78
3.5.17.11.10 LoadRezName ..... 3-78
3.5.17.11.11 DSDownload ..... 3-78
3.5.17.11.12 DSDnloadBreak ..... 3-78
3.5.17.11.13 DSDnloadState ..... 3-78
3.5.17.11.14 LoadDSName ..... 3-79
3.5.17.11.15 StartSave ..... 3-79
3.5.17.11.16 SaveState ..... 3-79
3.5.17.11.17 StartRestore ..... 3-79
3.5.17.11.18 RestoreState ..... 3-80
3.5.17.11.19 RestoreLineNr ..... 3-80
3.5.17.11.20 StartRezPrint ..... 3-80
3.5.17.11.21 RezPrintState ..... 3-80
3.5.17.11.22 StartUpload ..... 3-81
3.5.17.11.23 UploadDSNr ..... 3-81
3.5.17.11.24 UploadState ..... 3-81
3.5.17.12 Running Time Meters ..... 3-81
3.5.17.12.1 Counter1 to Counter8 ..... 3-81
3.5.17.13 Loop-Through Operation ..... 3-83
3.5.17.13.1 Pg2Sps ..... 3-83
3.5.17.13.2 Pg2SpsState ..... 3-83

3.5.17.14 Loadable Character Set ... 3-83
3.5.17.14.1 ChrsetName ... 3-83
3.5.17.15 Maintenance ... 3-84
3.5.17.15.1 User1 to User5 ... 3-84
3.5.17.15.2 LCDADCInput ... 3-84
3.5.17.15.3 LCDDACOutput ... 3-84
3.5.17.15.4 Break ... 3-84
3.5.17.15.5 StartCalibrationTouch ... 3-85
3.5.17.15.6 StateCalibrationTouch ... 3-85
3.5.17.15.7 MaskStartupTime ... 3-85
3.5.17.15.8 KeyResponseTime ... 3-86
3.5.17.16 Editors ... 3-86
3.5.17.16.1 EditInvers ... 3-86
3.5.17.16.2 EditEnter ... 3-86
3.5.17.16.3 StatePerm ... 3-86
3.5.17.17 Help ... 3-87
3.5.17.17.1 StateHelp ... 3-87
3.5.17.17.2 Message ... 3-87
3.5.17.17.3 QuitMessage ... 3-87
3.5.17.17.4 StatusText ... 3-88
3.5.17.17.5 StatusText21 ... 3-88
3.5.17.17.6 StatusText41 ... 3-88
3.5.17.17.7 StatusText61 ... 3-88
3.5.17.18 Print Logs ... 3-89
3.5.17.18.1 SelectPrintLog ... 3-89
3.5.17.18.2 StartPrintLog ... 3-89
3.5.17.18.3 StatePrintLog ... 3-89
3.5.17.18.4 PageNumber ... 3-89
3.5.17.19 Compact Flash Card ... 3-90
3.5.17.19.1 CardFileName ... 3-90
3.5.17.19.2 CardApplicationMove ... 3-90
3.5.17.19.3 CardDataSetMove ... 3-90
3.5.17.19.4 CardFileDelete ... 3-91
3.5.17.19.5 CardFileError ... 3-91
3.5.17.19.6 CFCardError ... 3-92
3.5.17.20 Set of Curves (Graph) ... 3-92
3.5.17.20.1 DataLogTrig ... 3-92
3.5.17.20.2 DataLogClear ... 3-93
3.5.17.21 Sound ... 3-93
3.5.17.21.1 Volume ... 3-93

3.6 Dynamic Attributes ... 3-93
3.6.1 Underline ... 3-94
3.6.2 Inverse ... 3-94
3.6.3 Flashing ... 3-94
3.6.4 Invisible ... 3-95
3.6.5 Non-Editable ... 3-95
3.6.6 Foreground ... 3-95
3.6.7 Background ... 3-95
3.6.8 Attribute Priorities ... 3-95
3.7 Set of Curves (Graph) ... 3-96
3.7.1 Data Logger ... 3-96
3.8 Images ... 3-98
3.9 Symbols ... 3-98

3.10 Buttons ... 3-99
3.10.1 Content of Buttons ... 3-99
3.10.2 Functions of Buttons ... 3-100
3.10.3 Representation of Buttons ... 3-100
3.10.3.1 Frames for Buttons ... 3-101
3.11 Function Keys/Softkeys ... 3-103
3.11.1 Direct Selector Keys ... 3-104
3.11.2 Function Keys in the Controller ... 3-104
3.11.3 Softkeys ... 3-104
3.11.4 Reaction Time of Function and Soft Keys ... 3-105
3.11.5 Using Control Keys as Function Keys ... 3-106
3.11.6 Function Keys Controlling Parallel Outputs ... 3-106
3.11.7 Status LEDs of Function Keys ... 3-106
3.12 Running Time Meter ... 3-107
3.13 Read Coordination Byte ... 3-108
3.13.1 Editing Request ... 3-109
3.13.2 Editing Status ... 3-109
3.13.3 Refresh Request ... 3-109
3.13.4 Liveness Flag ... 3-110
3.13.5 Data Set Download Active ... 3-110
3.14 Write Coordination Byte ... 3-110
3.14.1 External Data Release ... 3-111
3.14.2 Refresh Acknowledgment ... 3-111
3.14.3 Delete Password ... 3-111
3.14.4 Liveness Flag ... 3-112
3.14.5 Data Set Download Release ... 3-112
3.15 The Cyclical Polling Area ... 3-113
3.15.1 Byte-Oriented Polling Area ... 3-114
3.15.2 Word-Oriented Polling Area ... 3-116
3.15.3 Serial Message Channel ... 3-116
3.15.4 Image of the Status LEDs ... 3-117
3.15.5 Polling Time ... 3-117
3.15.6 Size of the Polling Area ... 3-118
3.16 Control Codes ... 3-118
3.16.1 Delete Data Logger ... 3-120
3.16.2 Trigger Data Logger ... 3-120
3.16.3 Write Values of Running Time Meters to Controller ... 3-120
3.16.4 Switch to Another Language ... 3-120
3.16.5 Automatic Data Release for Scanner Module ... 3-121
3.16.6 Reload Event-Controlled Variable Values ... 3-121
3.16.7 Transfer Single Data Set from Operating Device to Controller ... 3-121
3.16.8 Delete Acknowledged Messages from Serial Message Memory ... 3-121
3.16.9 Cancel Printing the Print Log ... 3-121
3.16.10 Printing a Print Log ... 3-122

3.16.11 Printing a Data Set ..... 3-122
3.16.12 Set Clock in Operating Device ..... 3-122
3.16.13 Data Set Transfer from Controller to Operating Device (Block Mode) ..... 3-123
3.16.14 Data Set Transfer from Operating Device to Controller ..... 3-123
3.16.15 Send Keyboard Image to Controller ..... 3-123
3.16.16 Data Set Transfer from Controller to Operating Device (Single Mode) ..... 3-123
3.16.17 Erase Serial Message Memory ..... 3-124
3.16.18 Refresh Message System ..... 3-124
3.17 Password Protection ..... 3-125
3.17.1 Password Management ..... 3-126
3.17.2 Reactivate Password Protection ..... 3-127
3.17.3 Password Mask and Password Functions ..... 3-127
3.18 Real Time Clock in the Operating Device ..... 3-128
3.18.1 Date and Time Image ..... 3-128
3.18.2 Setting the Real Time Clock from the Controller ..... 3-130
3.18.3 Transferring the Real-Time to the Controller ..... 3-130
3.19 Help System ..... 3-131
3.19.1 Default Help Mask ..... 3-131
3.19.2 Help Mask for Masks ..... 3-131
3.19.3 Help Mask for Input Variable ..... 3-131
3.19.4 Help Mask for Message Masks ..... 3-132
3.20 Print Logs ..... 3-133
3.20.1 Escape Sequences for Print Logs ..... 3-133
3.21 System Parameters ..... 3-134
3.21.1 General Parameters ..... 3-134
3.21.2 Polling Area ..... 3-135
3.21.3 Terminal Clock ..... 3-136
3.21.4 Running Time Meters ..... 3-136
3.21.5 Message System ..... 3-137
3.21.6 Variant Options ..... 3-138
3.21.7 Password Management ..... 3-139
3.21.8 Communication SER2 ..... 3-139
3.21.8.1 Connecting a Scanner ..... 3-139
3.21.9 Gateway ..... 3-140
3.21.10 Data Set Transfer ..... 3-140
3.21.11 Parallel Outputs ..... 3-140
3.21.12 Touch Parameters ..... 3-141
3.21.13 Print Logs ..... 3-141
3.22 Message System ..... 3-143
3.22.1 Internal Messages ..... 3-143
3.22.2 System Messages ..... 3-143
3.22.2.1 System Message 1 - Wrong format ..... 3-145

3.22.2.2 System Message 2 - Value too large ... 3-145
3.22.2.3 System Message 3 - Value too small ... 3-145
3.22.2.4 System Message 4 - Replace battery ... 3-146
3.22.2.5 System Message 5 - Message overflow ... 3-146
3.22.2.6 System Message 6 - New message ... 3-146
3.22.2.7 System Message 7 - Message buffer full ... 3-146
3.22.2.8 System Message 8 - Invalid mask no ... 3-146
3.22.2.9 System Message 9 - Invalid message no. ... 3-146
3.22.2.10 System Message 10 - Print log invalid ... 3-146
3.22.2.11 System Message 11 - Interface in use ... 3-146
3.22.2.12 System Message 12 - Invalid Password ... 3-147
3.22.2.13 System Message 13 - Password unchanged ... 3-147
3.22.2.14 System Message 14 - Overvoltage ... 3-147
3.22.2.15 System Message 15 - Data set protected ... 3-147
3.22.2.16 System Message 16 - Illegal data set ... 3-147
3.22.2.17 System Message 17 - Data set unknown ... 3-147
3.22.2.18 System Message 18 - Data set memory full ... 3-147
3.22.2.19 System message 19 - Data set active ... 3-147
3.22.2.20 System Message 20 - Data set transfer ... 3-147
3.22.2.21 System Message 21 - Password missing ... 3-148
3.22.2.22 System Message 22 - Editing mode active ... 3-148
3.22.2.23 System Message 23 - Data set file error ... 3-148
3.22.2.24 System Message 24 - Data set format ... 3-148
3.22.2.25 System Message 25 - Number invalid ... 3-148
3.22.2.26 System Message 26 - Loop-through active ... 3-148
3.22.2.27 System Message 27 - No data set address ... 3-148
3.22.2.28 System Message 28 - Recipe unknown ... 3-148
3.22.2.29 System Message 29 - Data set download ... 3-148
3.22.2.30 System Message 30 - Scanner error ... 3-149
3.22.2.31 System Message 31 - Print log unknown ... 3-149
3.22.2.32 System Message 32 - Error on changing the language ... 3-149
3.22.2.33 System Message 33 - Flash card information ... 3-149
3.22.2.34 System Message 34 - New appl. necessary ... 3-149
3.22.3 Suppressing the Display of System Messages ... 3-149
3.22.4 Error messages ... 3-150
3.22.5 External Messages ... 3-153
3.22.5.1 Structure of an External Message ... 3-153
3.22.5.1.1 Message Number ... 3-154
3.22.5.1.2 Message Text and Variable ... 3-154
3.22.5.2 Size of Message Memory ... 3-155
3.22.5.3 Message Sorting ... 3-155
3.22.5.4 Message Priority for Direct Display ... 3-156
3.22.5.5 Printing the Message Memory ... 3-156
3.22.5.6 Direct Call of the Message Mask ... 3-156
3.22.5.7 Message Output Formats ... 3-157
3.22.5.8 Zooming Messages ... 3-159
3.22.5.9 Acknowledging Messages ... 3-159
3.22.6 Serial Message System ... 3-159
3.22.6.1 Full-Page Message Output ... 3-160
3.22.6.2 Outputting Messages to a Logging Printer ... 3-160
3.22.6.3 Erasing the Message Memory Externally ... 3-161
3.22.7 Parallel Message System (Status Messages) ... 3-161
3.22.7.1 Settings for Status Messages ... 3-161

3.22.7.1.1 Size in Bytes ... 3-161
3.22.7.1.2 Polling Time ... 3-163
3.22.7.1.3 Variables for Status Messages ... 3-163
3.22.7.1.4 Variable for Acknowledging Messages ... 3-163
3.23 Recipes ... 3-163
3.23.1 Structure of a Recipe ... 3-166
3.23.2 Working with Recipes and Data Sets ... 3-166
3.23.2.1 Selecting a Recipe ... 3-166
3.23.2.2 Selecting a Data Set ... 3-167
3.23.2.3 Copying a Data Set ... 3-167
3.23.2.4 Deleting a Data Set ... 3-168
3.23.2.5 Modifying a Data Set ... 3-168
3.23.3 Data Set Transfer to/from Controller ... 3-169
3.23.3.1 Transfer to the Controller (Operator-Controlled) ... 3-170
3.23.3.2 Transfer to the Operating Device (Operator-Controlled) ... 3-171
3.23.3.3 Transferring Data Sets to / from a PC ... 3-171
3.23.3.4 Transfer to a PC ... 3-172
3.23.3.5 Transfer from a PC ... 3-172
3.23.3.6 Structure of a Data Set File ... 3-173
3.23.3.7 Printing Data Sets ... 3-175
3.23.3.8 Memory Requirement for Data Sets ... 3-175
3.24 Memory Requirement for Messages and Data Sets ... 3-176
3.25 Application ID ... 3-177
3.26 Version Number ... 3-178
3.27 Image of Mask Number ... 3-178
3.28 Image of User Mode Switch ... 3-178
3.29 Parallel Outputs ... 3-179
3.30 Screen Saver ... 3-179
3.31 Documentation ... 3-180
3.31.1 Documentation Parameters ... 3-180
3.31.1.1 Global Settings ... 3-180
3.31.1.2 Projects ... 3-180
3.31.1.3 Masks ... 3-180
3.31.1.4 Recipes ... 3-181
3.31.1.5 Help Masks ... 3-181
3.31.1.6 System Messages ... 3-182
3.31.1.7 Messages ... 3-182
3.32 Downloading a Project ... 3-183
3.32.1 Automatic Download Function ... 3-183
3.32.2 Download Cable 9 Pin ... 3-184
3.32.3 Download Cable 25 Pin ... 3-185
3.32.4 Download Cable for Hand-Held Operating Devices ... 3-186
3.33 Simulation Without a Controller (Demo Mode) ... 3-187

4 Transparent Mode ... 4-1
4.1 Setting the Operating Mode ... 4-1
4.2 Behavior of the Operating Device During Start-Up ... 4-2

4.3 Communication in Transparent Mode ... 4-2
4.4 Parameters for Interface X2, X3 SER1 ... 4-3
4.4.1 Receive Buffer for Interface X2 ... 4-3
4.4.2 Setup Menu Function ... 4-3
4.4.3 Changing the Parameters in the Setup Menu ... 4-3
4.5 Display ... 4-4
4.5.1 Character Set, Character Attributes ... 4-5
4.6 Keys ... 4-5
4.6.1 Key Codes for Each Operating Device ... 4-5
4.7 Control Characters for the Interface ... 4-7
4.7.1 LED Codes for the Operating Devices ... 4-8
4.7.2 Control Sequences for Operating Devices ... 4-9
4.8 Error Messages ... 4-12

5 Controller and Bus Connections ... 5-1
5.1 3964 RK512 ... 5-3
5.1.1 Procedure of the 3964 Protocol ... 5-3
5.1.1.1 Telegram for Connection Setup ... 5-3
5.1.1.2 Data Request Telegram ... 5-3
5.1.1.3 Data Request Telegram Header ... 5-4
5.1.1.3.1 Specification of the Data Types in the "Data Request" Telegram Header ... 5-5
5.1.1.4 Response Telegram ... 5-6
5.1.1.5 Data Transmission Telegram ... 5-6
5.1.1.6 Data Transmission Telegram Header ... 5-6
5.1.1.7 Special Features of the 3964R Protocol ... 5-7
5.1.1.7.1 Destination Information for a Write-Access via a Data Block ... 5-7
5.1.1.7.2 Restrictions of the 3964R Protocol ... 5-8
5.1.2 Data Types ... 5-8
5.1.3 Programming ... 5-10
5.1.3.1 Protocol Parameters ... 5-10
5.1.3.1.1 Baud Rate ... 5-10
5.1.3.1.2 Parity ... 5-10
5.1.3.1.3 Handshake ... 5-10
5.1.3.1.4 Data Bits ... 5-11
5.1.3.1.5 Stop Bits ... 5-11
5.1.3.1.6 Use Coordination Flag ... 5-11
5.1.3.1.7 Coordination Flag ... 5-11
5.1.3.1.8 Bit Number ... 5-11
5.1.3.1.9 Data Block Number ... 5-12
5.1.3.1.10 Data Block Word ... 5-12
5.1.3.1.11 Floating Point Number in the Siemens Format ... 5-12
5.1.3.1.12 Block Check ... 5-12
5.1.3.1.13 CPU Number ... 5-12
5.1.3.1.14 Full Duplex ... 5-13
5.1.3.1.15 Half Duplex ... 5-13
5.1.3.2 Input Syntax ... 5-14
5.1.4 Physical Interfacing ... 5-15
5.1.4.1 Pin Assignment for Operating Devices with an Universal Interface ... 5-15
5.1.4.2 Pin Assignment for Operating Devices without an Universal Interface ... 5-16
5.1.4.3 Cable X3 SER1 TTY / 20 mA - Siemens S5 CP524/525 and Helmholz SAS 523/525 ... 5-18

5.1.4.4 Cable X2 TTY / 20 mA - Siemens S5 CP524/525 and Helmholz SAS 523/525 ..... 5-19
5.1.4.5 Cable X3 SER1 RS232 - Siemens S5 CP523/525 ..... 5-20
5.1.4.6 Cable X2 RS232 - Siemens S5 CP 523/525 ..... 5-21
5.1.4.7 Cable X3 SER1 RS485 - Siemens S5 CP 523/525 ..... 5-22
5.1.4.8 Cable X2 RS485 - Siemens S5 CP 523/525 ..... 5-23
5.1.4.9 Cable X3 SER1 RS485 - Siemens S5 with Helmholz SAS 523/525 ..... 5-24
5.1.4.10 Cable X2 RS485 - Siemens S5 with Helmholz SAS 523/525 ..... 5-25
5.1.4.11 Cable X3 SER1 RS485 - Siemens S5 with VIPA BGM79-43 ..... 5-26
5.1.4.12 Cable X2 RS485 - Siemens S5 with VIPA BGM79-43 ..... 5-27
5.1.4.13 Cable X3 SER1 TTY / 20 mA - EBERLE PLS514 - K43 ..... 5-28
5.1.4.14 Cable X2 TTY / 20 mA - EBERLE PLS514 - K43 ..... 5-29
5.1.4.15 Cable X3 SER1 RS232 - EBERLE PLS514 - K43 ..... 5-30
5.1.4.16 Cable X2 RS232 - EBERLE PLS514 - K43 ..... 5-31
5.1.5 Error Messages ..... 5-32
5.1.6 Applications ..... 5-34
5.1.6.1 Connection to Siemens S5 115U ..... 5-34
5.1.6.2 Connection to EBERLE PLS514 with communication block K43 ..... 5-35
5.1.6.2.1 Protocol Parameters for TTY / 20 mA ..... 5-36
5.1.6.2.2 Protocol Parameters for RS232 ..... 5-36
5.1.6.2.3 Initializing the K43 module ..... 5-37
5.2 3S sarti ..... 5-43
5.2.1 Data Types ..... 5-43
5.2.1.1 Single Variables ..... 5-43
5.2.1.2 String Variables ..... 5-43
5.2.2 Programming ..... 5-44
5.2.2.1 Protocol Parameters ..... 5-44
5.2.2.1.1 Path for Variable List *.sym ..... 5-44
5.2.2.2 System Parameters ..... 5-44
5.2.2.2.1 Poll Area ..... 5-44
5.2.2.2.2 Status Messages ..... 5-44
5.2.2.2.3 Date and Time ..... 5-44
5.2.2.2.4 Variant Buffer ..... 5-44
5.2.2.2.5 Tables ..... 5-45
5.2.3 Error Messages ..... 5-46
5.2.4 Applications ..... 5-47
5.2.4.1 CoDeSys Version 2.2 or Higher ..... 5-47
5.2.4.1.1 Declaring Global Variables ..... 5-47
5.2.4.1.2 Activate Output into Symbol File ..... 5-47
5.2.4.1.3 Target System Settings ..... 5-49
5.3 3S serial ..... 5-51
5.3.1 Data Types ..... 5-51
5.3.1.1 Single Variables ..... 5-51
5.3.1.2 String Variables ..... 5-51
5.3.2 Programming ..... 5-52
5.3.2.1 Protocol Parameters ..... 5-52
5.3.2.1.1 Baud Rate ..... 5-52
5.3.2.1.2 Parity ..... 5-52
5.3.2.1.3 Data Bits ..... 5-52
5.3.2.1.4 Stop Bits ..... 5-52
5.3.2.1.5 Waiting Time for Response ..... 5-53
5.3.2.1.6 Delay until Connection Set-Up ..... 5-53
5.3.2.1.7 Byte Order ..... 5-53
5.3.2.1.8 Controllers ..... 5-53

5.3.2.1.9 Path for Variable List *.sym ..... 5-53
5.3.2.2 System Parameters ..... 5-54
5.3.2.2.1 Poll Area ..... 5-54
5.3.2.2.2 Status Messages ..... 5-54
5.3.2.2.3 Date and Time ..... 5-54
5.3.2.3 Physical Interfacing ..... 5-55
5.3.2.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-55
5.3.2.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-55
5.3.2.3.3 Cable X3 SER1 RS232 - Schraml PLC FWM105 ..... 5-56
5.3.2.3.4 Cable X2 RS232 - Schraml SPS FWM105 ..... 5-57
5.3.2.3.5 Cable X3 SER1 RS232 - Schraml SPS FWM160 ..... 5-58
5.3.2.3.6 Cable X2 RS232 - Schraml SPS FWM160 ..... 5-59
5.3.3 Error Messages ..... 5-60
5.3.4 Applications ..... 5-61
5.3.4.1 CoDeSys Version 2.2 or Higher ..... 5-61
5.3.4.1.1 Declaring Global Variables ..... 5-61
5.3.4.1.2 Activate Output into Symbol File ..... 5-61
5.3.4.1.3 Variable List ..... 5-63
5.4 3S Symbolic ..... 5-65
5.4.1 Data Types ..... 5-65
5.4.1.1 Single Variables ..... 5-65
5.4.1.2 String Variables ..... 5-65
5.4.2 Programming ..... 5-66
5.4.2.1 Protocol Parameters ..... 5-66
5.4.2.1.1 Baud rate ..... 5-66
5.4.2.1.2 Parity ..... 5-66
5.4.2.1.3 Data Bits ..... 5-66
5.4.2.1.4 Stop Bits ..... 5-66
5.4.2.1.5 Waiting Time for Response ..... 5-67
5.4.2.1.6 Delay until Connection Set-Up ..... 5-67
5.4.2.1.7 Byte Order ..... 5-67
5.4.2.1.8 Controllers ..... 5-67
5.4.2.1.9 Path for Variable List *.sym ..... 5-67
5.4.2.2 System Parameters ..... 5-67
5.4.2.2.1 Poll Area ..... 5-67
5.4.2.2.2 Status Messages ..... 5-68
5.4.2.2.3 Date and Time ..... 5-68
5.4.3 Physical Interfacing ..... 5-69
5.4.3.1 Pin assignment for operating devices with a universal interface ..... 5-69
5.4.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-69
5.4.3.3 Cable X3 SER1 RS232 - Schraml PLC FWM105 ..... 5-70
5.4.3.4 Cable X2 RS232 - Schraml SPS FWM105 ..... 5-71
5.4.3.5 Cable X3 SER1 RS232 - Schraml SPS FWM160 ..... 5-72
5.4.3.6 Cable X2 RS232 - Schraml SPS FWM160 ..... 5-73
5.4.4 Error Messages ..... 5-74
5.4.5 Applications ..... 5-75
5.4.5.1 CoDeSys Version 2.2 or Higher ..... 5-75
5.4.5.1.1 Declaring Global Variables ..... 5-75
5.4.5.1.2 Activate Output into Symbol File ..... 5-75
5.4.5.1.3 Variable List ..... 5-77
5.5 ABB Arcnet ..... 5-79
5.5.1 Hardware ..... 5-79
5.5.2 Telegram Setup ..... 5-79

5.5.3 Data Types ..... 5-80
5.5.4 Programming ..... 5-82
5.5.4.1 Protocol Parameters ..... 5-82
5.5.4.1.1 Maximum Waiting Time For Response ..... 5-82
5.5.4.1.2 Delay until Connection Set-Up ..... 5-82
5.5.4.1.3 Baud Rate ..... 5-82
5.5.4.1.4 Node Address ..... 5-82
5.5.4.1.5 Maximum Number of Nodes ..... 5-83
5.5.4.1.6 Initializing Values for Timer ..... 5-83
5.5.4.1.7 Modbus Parameters ..... 5-83
5.5.4.2 Input Syntax ..... 5-84
5.5.4.2.1 Syntax for Inputs ..... 5-84
5.5.4.2.2 Syntax for Outputs ..... 5-85
5.5.4.2.3 Syntax for Flag Area ..... 5-85
5.5.4.2.4 Syntax for Constants ..... 5-85
5.5.4.2.5 Syntax for Step Sequence ..... 5-86
5.5.4.3 System Parameters ..... 5-86
5.5.4.3.1 Poll Area ..... 5-86
5.5.4.3.2 Status Messages ..... 5-86
5.5.4.3.3 Internally used flag addresses ..... 5-87
5.5.5 Physical Interfacing ..... 5-88
5.5.5.1 Cable for Arcnet with BNC Connectors ..... 5-89
5.5.5.2 Cable for Arcnet with RJ45 Connector ..... 5-89
5.5.6 Error Messages ..... 5-90
5.6 ABB CS31 ..... 5-91
5.6.1 Data Types ..... 5-91
5.6.2 Programming ..... 5-92
5.6.2.1 Protocol Parameters ..... 5-92
5.6.2.1.1 Baud Rate ..... 5-92
5.6.2.1.2 Parity ..... 5-92
5.6.2.1.3 Handshake ..... 5-92
5.6.2.1.4 Data Bits ..... 5-93
5.6.2.1.5 Stop Bits ..... 5-93
5.6.2.1.6 Maximum Waiting Time For Response ..... 5-93
5.6.2.1.7 Delay until Connection Set-Up ..... 5-93
5.6.2.2 Input Syntax ..... 5-94
5.6.2.3 System Parameters ..... 5-94
5.6.2.3.1 Poll Area ..... 5-94
5.6.2.3.2 Status Messages ..... 5-95
5.6.3 Physical Interfacing ..... 5-96
5.6.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-96
5.6.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-96
5.6.3.3 Cable X2 RS232 - ABB CS31 ..... 5-97
5.6.3.4 Cable X3 SER1 RS232 - ABB CS31 ..... 5-97
5.6.4 Error Messages ..... 5-98
5.7 ABB T200 ..... 5-99
5.7.1 Data Types ..... 5-99
5.7.1.1 Value Ranges for the Data Types ..... 5-100
5.7.2 Programming ..... 5-101
5.7.2.1 Protocol Parameters ..... 5-101
5.7.2.1.1 Baud Rate ..... 5-101
5.7.2.1.2 Parity ..... 5-101
5.7.2.1.3 Handshake ..... 5-101
5.7.2.1.4 Data Bits ..... 5-102

5.7.2.1.5 Stop Bits ..... 5-102
5.7.2.1.6 Maximum Waiting Time For Response ..... 5-102
5.7.2.1.7 Delay until Connection Set-Up ..... 5-102
5.7.2.1.8 Additional Parameters ..... 5-103
5.7.2.1.9 1:N Communication ..... 5-103
5.7.2.1.10 Access Authorization Control ..... 5-103
5.7.2.2 Input Syntax ..... 5-104
5.7.2.3 System Parameters ..... 5-104
5.7.2.3.1 Poll Area ..... 5-104
5.7.2.4 Status Messages ..... 5-105
5.7.3 Physical Interfacing ..... 5-106
5.7.3.1 Pin assignment for operating devices with a universal interface ..... 5-106
5.7.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-106
5.7.3.3 Cable X3 SER1 RS232 - ABB T200 ..... 5-108
5.7.3.4 Cable X2 RS232 - ABB T200 ..... 5-109
5.7.3.5 Cable X3 SER1 RS485 - ABB T200 ..... 5-110
5.7.3.6 Cable X2 RS485 - ABB T200 ..... 5-111
5.7.4 Error Messages ..... 5-112
5.8 AEG KS ..... 5-115
5.8.1 Data Types ..... 5-115
5.8.2 Programming ..... 5-116
5.8.2.1 Protocol Parameters ..... 5-116
5.8.2.1.1 Baud Rate ..... 5-116
5.8.2.1.2 Parity ..... 5-116
5.8.2.1.3 Handshake ..... 5-116
5.8.2.1.4 Data Bits ..... 5-117
5.8.2.1.5 Stop Bits ..... 5-117
5.8.2.2 Input Syntax ..... 5-118
5.8.3 Physical Interfacing ..... 5-119
5.8.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-119
5.8.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-120
5.8.3.3 Cable X3 SER1 RS232 - AEG A120 and A250 ..... 5-122
5.8.3.4 Cable X2 RS232 - AEG A120 and A250 ..... 5-123
5.8.4 Error Messages ..... 5-124
5.9 Allen Bradley ..... 5-125
5.9.1 Data Types ..... 5-125
5.9.2 Programming ..... 5-126
5.9.2.1 Protocol Parameters ..... 5-126
5.9.2.1.1 Baud Rate ..... 5-126
5.9.2.1.2 Parity ..... 5-126
5.9.2.1.3 Handshake ..... 5-126
5.9.2.1.4 Data Bits ..... 5-127
5.9.2.1.5 Stop Bits ..... 5-127
5.9.2.1.6 PLC Type ..... 5-127
5.9.2.1.7 Block Check ..... 5-127
5.9.2.2 Input Syntax ..... 5-128
5.9.3 Physical Interfacing ..... 5-129
5.9.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-129
5.9.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-129
5.9.3.3 Cable X3 SER1 RS232 - Allen Bradley SLC 500-5/03 ..... 5-131
5.9.3.4 Cable X2 RS232 - Allen Bradley SLC 500-5/03 ..... 5-132
5.9.3.5 Cable X3 SER1 RS485 - Allen Bradley PLC 5 ..... 5-133
5.9.3.6 Cable X2 RS485 - Allen Bradley PLC 5 ..... 5-134

5.9.4 Error Messages ..... 5-135
5.10 Bosch BUEP19 ..... 5-137
5.10.1 Data Types ..... 5-137
5.10.2 Programming ..... 5-139
5.10.2.1 Protocol Parameters ..... 5-139
5.10.2.1.1 Baud Rate ..... 5-139
5.10.2.1.2 Parity ..... 5-139
5.10.2.1.3 Handshake ..... 5-139
5.10.2.1.4 Data Bits ..... 5-140
5.10.2.1.5 Stop Bits ..... 5-140
5.10.2.1.6 Use Coordination Flag ..... 5-140
5.10.2.1.7 Coordination Flag ..... 5-140
5.10.2.1.8 Bit Number ..... 5-140
5.10.2.1.9 Destination Module ..... 5-141
5.10.2.1.10 Block Check ..... 5-141
5.10.2.2 Input Syntax ..... 5-142
5.10.3 Physical Interfacing ..... 5-143
5.10.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-143
5.10.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-143
5.10.3.3 Cable X3 SER1 TTY / 20 mA - Bosch PU ..... 5-144
5.10.3.4 Cable X2 TTY / 20 mA - Bosch PU ..... 5-145
5.10.4 Error Messages ..... 5-146
5.11 Bosch BUEP19E ..... 5-149
5.11.1 Data Types ..... 5-149
5.11.2 Programming ..... 5-151
5.11.2.1 Protocol Parameters ..... 5-151
5.11.2.1.1 Baud Rate ..... 5-151
5.11.2.1.2 Parity ..... 5-151
5.11.2.1.3 Handshake ..... 5-151
5.11.2.1.4 Data Bits ..... 5-152
5.11.2.1.5 Stop Bits ..... 5-152
5.11.2.1.6 Use Coordination Flag ..... 5-152
5.11.2.1.7 Coordination Flag ..... 5-152
5.11.2.1.8 Process Coordination Flag ..... 5-153
5.11.2.1.9 Destination Module ..... 5-153
5.11.2.1.10 Block Check ..... 5-153
5.11.2.2 Input Syntax ..... 5-154
5.11.3 Physical Interfacing ..... 5-155
5.11.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-155
5.11.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-155
5.11.3.3 Cable X3 SER1 TTY / 20 mA - Bosch PU ..... 5-156
5.11.3.4 Cable X2 TTY / 20 mA - Bosch PU ..... 5-157
5.11.4 Error Messages ..... 5-158
5.12 CAN ..... 5-161
5.12.1 Data Objects ..... 5-161
5.12.2 Identifier ..... 5-161
5.12.3 PDO Communication ..... 5-161
5.12.3.1 Indirect process data communication ..... 5-161
5.12.3.2 Data exchange sequence ..... 5-162
5.12.3.3 Structure of Request and Response PDO ..... 5-162
5.12.3.4 Structure of the Status Byte ..... 5-162
5.12.3.5 Index bytes ..... 5-163

5.12.3.6 Subindex Byte ..... 5-163
5.12.3.7 User data bytes of request and response PDO ..... 5-163
5.12.3.8 Response Object With an Error ..... 5-164
5.12.3.9 Tasks of the Communication Partner ..... 5-164
5.12.3.9.1 Procedure for Communication Without Errors ..... 5-165
5.12.3.9.2 Procedure for Communication with Errors ..... 5-165
5.12.4 SDO Communication ..... 5-165
5.12.4.1 Server SDO ..... 5-165
5.12.4.2 Client SDO ..... 5-165
5.12.5 CANopen in TesiMod Operating Devices ..... 5-165
5.12.5.1 NMT Capability ..... 5-165
5.12.5.2 Object Dictionary ..... 5-166
5.12.5.3 Object Description ..... 5-167
5.12.5.3.1 Guard Time ..... 5-167
5.12.5.3.2 Life Time Factor ..... 5-167
5.12.5.3.3 Store Parameters ..... 5-168
5.12.5.3.4 Restore Default Parameters ..... 5-168
5.12.6 Programming ..... 5-169
5.12.6.1 Protocol Parameters ..... 5-169
5.12.6.1.1 Baud Rate ..... 5-169
5.12.6.1.2 Maximum Waiting Time For Response ..... 5-169
5.12.6.1.3 Delay until Connection Set-Up ..... 5-169
5.12.6.1.4 Register Errors in Serial Message System ..... 5-169
5.12.6.1.5 Use CANopen ..... 5-170
5.12.6.1.6 Terminal Status on the Bus ..... 5-170
5.12.6.1.7 Node Guarding for SDO Channels ..... 5-171
5.12.6.1.8 Communication Relations ..... 5-172
5.12.6.1.9 Terminal Module Number ..... 5-172
5.12.6.1.10 Communication Over ..... 5-172
5.12.6.1.11 Identifier Settings ..... 5-172
5.12.6.2 System Parameters ..... 5-173
5.12.6.2.1 Poll Area via PDO Channel ..... 5-173
5.12.6.2.2 Poll Area via SDO Channel ..... 5-174
5.12.6.2.3 Parallel Message System via PDO Channel ..... 5-174
5.12.6.2.4 Parallel Message System via SDO Channel ..... 5-175
5.12.6.2.5 Strings via the SDO Channel ..... 5-175
5.12.6.2.6 Tables via the SDO Channel ..... 5-175
5.12.6.3 Input Syntax ..... 5-176
5.12.7 Physical Interfacing ..... 5-177
5.12.7.1 Cable X2 - CAN ..... 5-177
5.12.8 Error Messages ..... 5-178
5.12.9 Applications ..... 5-180
5.12.9.1 Examples for Communication Relations ..... 5-180
5.13 DeviceNet ..... 5-183
5.13.1 Explicit Message ..... 5-183
5.13.1.1 Storing Data ..... 5-183
5.13.1.2 Exchanging Data ..... 5-183
5.13.1.3 Data Memory ..... 5-183
5.13.1.4 Read Service ..... 5-184
5.13.1.5 Write Service ..... 5-185
5.13.1.6 Fragmentation ..... 5-185
5.13.2 Poll I/O Connection ..... 5-186
5.13.2.1 Receive Data of the Operating Device (Consumed Data) ..... 5-186
5.13.2.2 Transmit Data of the Operating Device (Produced Data) ..... 5-186

5.13.2.2.1 Byte 1 - Initialization ... 5-186
5.13.2.2.2 Byte 2 - Control Byte ... 5-186
5.13.2.2.3 Byte 3 and Byte 4 - Word Address ... 5-187
5.13.2.2.4 Byte 5 - Number of Bytes ... 5-187
5.13.2.3 Module /Network Status ... 5-187
5.13.3 Programming ... 5-188
5.13.3.1 Protocol Parameters ... 5-188
5.13.3.1.1 Baud Rate ... 5-188
5.13.3.1.2 Node Number ... 5-188
5.13.3.1.3 Delay until Connection Set-Up ... 5-188
5.13.3.1.4 Waiting Time for Response ... 5-188
5.13.3.1.5 Attribute ... 5-189
5.13.3.1.6 Byte Order ... 5-189
5.13.3.2 Input Syntax ... 5-190
5.13.3.3 Variables ... 5-190
5.13.3.4 System Variables ... 5-190
5.13.3.4.1 ComBaudrateA ... 5-190
5.13.3.4.2 ComHandshakeA ... 5-191
5.13.4 Object Definitions ... 5-191
5.13.4.1 Identity Object ... 5-191
5.13.4.1.1 Instance Attribute ... 5-191
5.13.4.1.2 Instance Service ... 5-192
5.13.4.1.3 Message Router Object ... 5-192
5.13.4.2 DeviceNet Object ... 5-192
5.13.4.2.1 Class Service ... 5-192
5.13.4.2.2 Instance Attribute ... 5-192
5.13.4.2.3 Instance Service ... 5-192
5.13.4.3 Assembly Object ... 5-192
5.13.4.4 Connection Object ... 5-192
5.13.4.4.1 Class Service ... 5-192
5.13.4.4.2 Instance Attribute ... 5-193
5.13.4.4.3 Instance Service ... 5-193
5.13.4.4.4 BT Object ... 5-193
5.13.4.4.5 Instance Service ... 5-193
5.13.5 Format of the Explicit Message High Byte ... 5-197
5.13.6 EDS File ... 5-199
5.13.7 Physical Interfacing ... 5-200
5.13.7.1 Cable X2.1 / X2.2 - DeviceNet ... 5-201
5.13.8 Error Messages ... 5-202
5.13.9 Applications ... 5-203
5.13.9.1 Rockwell SLC 505 - 1747 SDN/B ... 5-203
5.13.9.2 OMRON DRM 21-V1 ... 5-203
5.14 DIN Measurement Bus ... 5-205
5.14.1 DIN Measurement Bus Master ... 5-206
5.14.1.1 Extended Poll Area ... 5-206
5.14.1.2 Cache Function for Read-Only Data ... 5-208
5.14.1.3 Network Status ... 5-208
5.14.2 Programming ... 5-209
5.14.2.1 Protocol Parameters for the PLC Connection ... 5-209
5.14.2.2 Protocol Parameters for the DIN Measurement Bus Master ... 5-209
5.14.2.2.1 Baud Rate ... 5-209
5.14.2.2.2 Parity ... 5-210
5.14.2.2.3 Handshake ... 5-210
5.14.2.2.4 Data Bits ... 5-210

5.14.2.2.5 Stop Bits ..... 5-210
5.14.2.2.6 Slave Number ..... 5-211
5.14.3 Additional Error Messages ..... 5-212
5.14.4 DIN Measurement Bus Slave ..... 5-213
5.14.5 Programming ..... 5-214
5.14.5.1 Protocol Parameters for the DIN Measurement Bus Slave ..... 5-214
5.14.5.1.1 Baud Rate ..... 5-214
5.14.5.1.2 Parity ..... 5-214
5.14.5.1.3 Handshake ..... 5-214
5.14.5.1.4 Data Bits ..... 5-215
5.14.5.1.5 Stop Bits ..... 5-215
5.14.5.1.6 Timeout for Order Reply ..... 5-215
5.14.5.1.7 Timeout for Cache Update ..... 5-215
5.14.5.1.8 Slave Number ..... 5-216
5.14.6 Physical Interfacing ..... 5-217
5.14.6.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-217
5.14.6.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-217
5.14.6.3 Cable X3 SER1 RS485 - Master/Slave ..... 5-218
5.14.6.4 Cable X2 RS485 - Master/Slave ..... 5-219
5.14.7 Error Messages ..... 5-220
5.15 Fanuc SNP ..... 5-221
5.15.1 Data Types ..... 5-221
5.15.2 Programming ..... 5-222
5.15.2.1 Protocol Parameters ..... 5-222
5.15.2.1.1 Baud Rate ..... 5-222
5.15.2.1.2 Parity ..... 5-222
5.15.2.1.3 Handshake ..... 5-222
5.15.2.1.4 Data Bits ..... 5-223
5.15.2.1.5 Stop Bits ..... 5-223
5.15.2.1.6 Maximum Waiting Time For Response ..... 5-223
5.15.2.1.7 Delay until Connection Set-Up ..... 5-223
5.15.2.2 Input Syntax ..... 5-224
5.15.3 Physical Interfacing ..... 5-225
5.15.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-225
5.15.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-225
5.15.3.3 Cable X3 SER1 RS485 - Fanuc Series 90 ..... 5-226
5.15.3.4 Cable X2 RS485 - Fanuc Series 90 ..... 5-227
5.15.3.5 Cable X3 SER1 RS485 - Fanuc CMM311 ..... 5-228
5.15.3.6 Cable X2 RS485 - Fanuc CMM311 ..... 5-229
5.15.4 Error Messages ..... 5-230
5.16 Idec Micro3 ..... 5-231
5.16.1 Data Types ..... 5-231
5.16.2 Programming ..... 5-232
5.16.2.1 Protocol Parameters ..... 5-232
5.16.2.1.1 Baud Rate ..... 5-232
5.16.2.1.2 Parity ..... 5-232
5.16.2.1.3 Handshake ..... 5-232
5.16.2.1.4 Data Bits ..... 5-233
5.16.2.1.5 Stop Bits ..... 5-233
5.16.2.1.6 Maximum Waiting Time For Response ..... 5-233
5.16.2.1.7 Delay until Connection Set-Up ..... 5-233
5.16.2.2 Input Syntax ..... 5-234
5.16.3 Physical Interfacing ..... 5-235

5.16.3.1 Pin assignment for operating devices with a universal interface ... 5-235
5.16.3.2 Pin Assignment for Operating Devices without an Universal Interface ... 5-235
5.16.3.3 Cable X3 SER1 RS485 - Idec Micro3 ... 5-236
5.16.3.4 Cable X2 RS485 - Idec Micro3 ... 5-237
5.16.4 Error Messages ... 5-238
5.17 INTERBUS MMICOM Interface 02, 10, 15, 23 ... 5-241
5.17.1 MMICOM Structure ... 5-242
5.17.2 Data Types ... 5-243
5.17.3 Programming ... 5-244
5.17.3.1 Protocol Parameters ... 5-244
5.17.3.1.1 Baud Rate ... 5-244
5.17.3.1.2 Parity ... 5-244
5.17.3.1.3 Handshake ... 5-245
5.17.3.1.4 Data Bits ... 5-245
5.17.3.1.5 Stop Bits ... 5-245
5.17.3.1.6 MMICOM Handshake Timeout ... 5-245
5.17.3.1.7 Maximum Waiting Time for Response ... 5-245
5.17.3.1.8 Delay until Connection Set-Up ... 5-246
5.17.3.1.9 Floating Point Number in the Siemens Format ... 5-246
5.17.3.2 Input Syntax ... 5-247
5.17.4 Physical Interfacing ... 5-248
5.17.4.1 Pin Assignment for Operating Devices with an Universal Interface ... 5-248
5.17.4.2 Pin Assignment for Operating Devices without an Universal Interface ... 5-248
5.17.4.3 Pin Assignment for Bus Node ... 5-248
5.17.4.4 Cable X3 SER1 RS232 - Bus Node BK06 ... 5-250
5.17.5 Error Messages ... 5-251
5.18 INTERBUS Siemens S7 Functions, Interface 02, 10, 23 ... 5-253
5.18.1 PCP Structure ... 5-253
5.18.1.1 ID Code ... 5-253
5.18.1.2 Process Data ... 5-253
5.18.2 Data Types ... 5-253
5.18.3 Programming ... 5-255
5.18.3.1 Protocol Parameters ... 5-255
5.18.3.1.1 Baud Rate ... 5-255
5.18.3.1.2 Parity ... 5-255
5.18.3.1.3 Handshake ... 5-255
5.18.3.1.4 Data Bits ... 5-256
5.18.3.1.5 Stop Bits ... 5-256
5.18.3.1.6 Maximum Waiting Time for Response ... 5-256
5.18.3.1.7 Delay until Connection Set-Up ... 5-256
5.18.3.1.8 Floating Point Number in the Siemens Format ... 5-257
5.18.3.1.9 Data Consistency via Hardware ... 5-257
5.18.3.2 Input Syntax ... 5-258
5.18.4 Physical Interfacing ... 5-259
5.18.4.1 Pin Assignment for Operating Devices with an Universal Interface ... 5-259
5.18.4.2 Pin assignment for operating devices without a universal interface ... 5-259
5.18.4.3 Pin Assignment for Bus Node ... 5-259
5.18.4.4 Cable X3 SER1 RS232 - Bus Node BK06 ... 5-261
5.18.5 Error Messages ... 5-262
5.18.6 Applications ... 5-266
5.18.6.1 Siemens S7-400 ... 5-266
5.18.6.1.1 OB1 ... 5-266

5.18.6.1.2 OB100 and OB101 ..... 5-267
5.18.6.1.3 Function Block FB71 ..... 5-268
5.18.6.1.4 Function Block FB171 ..... 5-272
5.18.6.1.5 Function FC3 ..... 5-273
5.18.6.1.6 Function FC8 ..... 5-273
5.18.6.1.7 Function FC11 "INIT_IB" ..... 5-273
5.18.6.1.8 Function FC12 "MEM_READ" ..... 5-275
5.18.6.1.9 Function FC13 "IB_DIAG" ..... 5-276
5.18.6.1.10 Function FC14 "MEM_WRITE" ..... 5-277
5.18.6.1.11 Function FC18 "IB_SERV" ..... 5-277
5.18.6.1.12 Function FC19 "GETCONF" ..... 5-278
5.18.6.1.13 Function FC78 ..... 5-279
5.18.6.1.14 System Function SFC51 "RDSYSST" ..... 5-280
5.19 Jetter ..... 5-281
5.19.1 Data Types ..... 5-281
5.19.1.1 Address Definition ..... 5-281
5.19.2 Programming ..... 5-284
5.19.2.1 Protocol Parameters ..... 5-284
5.19.2.1.1 Baud Rate ..... 5-284
5.19.2.1.2 Parity ..... 5-284
5.19.2.1.3 Handshake ..... 5-284
5.19.2.1.4 Data Bits ..... 5-285
5.19.2.1.5 Stop Bits ..... 5-285
5.19.2.1.6 Maximum Waiting Time For Response ..... 5-285
5.19.2.1.7 Delay until Connection Set-Up ..... 5-285
5.19.2.1.8 Jetter CPU Type ..... 5-285
5.19.2.1.9 Jetter Protocol Type ..... 5-286
5.19.2.1.10 Structure of Poll Area/Status Messages ..... 5-286
5.19.2.2 Input Syntax ..... 5-287
5.19.2.3 System Parameters ..... 5-287
5.19.2.3.1 Poll Area ..... 5-287
5.19.2.3.2 Status Messages ..... 5-288
5.19.3 Physical Interfacing ..... 5-289
5.19.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-289
5.19.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-289
5.19.3.3 Cable X3 SER1 RS232 - Jetter ..... 5-290
5.19.3.4 Cable X2 RS232 - Jetter ..... 5-291
5.19.4 Error Messages ..... 5-292
5.20 Mitsubishi FX ..... 5-293
5.20.1 Data Types ..... 5-293
5.20.2 Programming ..... 5-294
5.20.2.1 Protocol Parameters ..... 5-294
5.20.2.1.1 Baud Rate ..... 5-294
5.20.2.1.2 Parity ..... 5-294
5.20.2.1.3 Handshake ..... 5-294
5.20.2.1.4 Data Bits ..... 5-295
5.20.2.1.5 Stop Bits ..... 5-295
5.20.2.1.6 Maximum Waiting Time For Response ..... 5-295
5.20.2.1.7 Delay until Connection Set-Up ..... 5-295
5.20.2.2 Input Syntax ..... 5-296
5.20.3 Physical Interfacing ..... 5-297
5.20.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-297
5.20.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-297
5.20.3.3 Cable X3 SER1 RS485 - Mitsubishi FX ..... 5-298

5.20.3.4 Cable X2 RS485 - Mitsubishi FX ... 5-299
5.20.3.5 Cable X3 SER1 RS485 - Mitsubishi FX0 ... 5-300
5.20.3.6 Cable X2 RS485 - Mitsubishi FX0 ... 5-301
5.20.4 Error Messages ... 5-302
5.21 Mitsubishi MelsecA ... 5-303
5.21.1 Data Types ... 5-303
5.21.2 Programming ... 5-305
5.21.2.1 Protocol Parameters ... 5-305
5.21.2.1.1 Baud Rate ... 5-305
5.21.2.1.2 Parity ... 5-305
5.21.2.1.3 Handshake ... 5-305
5.21.2.1.4 Data Bits ... 5-306
5.21.2.1.5 Stop Bits ... 5-306
5.21.2.1.6 Maximum Waiting Time For Response ... 5-306
5.21.2.1.7 Delay until Connection Set-Up ... 5-306
5.21.2.1.8 Mitsubishi CPU Type ... 5-306
5.21.2.2 Input Syntax ... 5-307
5.21.3 Physical Interfacing ... 5-308
5.21.3.1 Pin Assignment for Operating Devices with an Universal Interface ... 5-308
5.21.3.2 Pin Assignment for Operating Devices without an Universal Interface ... 5-308
5.21.3.3 Cable X3 SER1 RS485 - Mitsubishi MelsecA ... 5-309
5.21.3.4 Cable X2 RS485 - Mitsubishi MelsecA ... 5-310
5.21.4 Error Messages ... 5-311
5.22 MMICOM ... 5-313
5.22.1 Integration of the Operating Devices ... 5-313
5.22.2 MMICOM Profile ... 5-314
5.22.2.1 Direct Process Data Channel ... 5-314
5.22.2.2 Indirect Process Data Channel ... 5-314
5.22.2.3 Parameter Channel ... 5-314
5.22.3 Connecting the Operating Device ... 5-314
5.22.3.1 Specification for INTERBUS ... 5-315
5.22.4 Programming ... 5-316
5.22.4.1 Protocol Parameters ... 5-316
5.22.4.1.1 MMICOM Handshake Timeout ... 5-316
5.22.4.1.2 Delay until Connection Set-Up ... 5-316
5.22.4.1.3 Floating Point Number in the Siemens Format ... 5-316
5.22.4.2 System Parameters ... 5-316
5.22.4.2.1 Poll Area ... 5-317
5.22.4.2.2 Status Messages ... 5-317
5.22.4.3 Data Types ... 5-317
5.22.4.4 Input Syntax ... 5-319
5.22.4.4.1 Variable Number ... 5-319
5.22.5 Physical Interfacing ... 5-320
5.22.5.1 Pin Assignment ... 5-320
5.22.5.2 2-Wire Remote Bus Cable ... 5-321
5.22.5.3 Converting from 8-Wire Protocol to 2-Wire Protocol ... 5-322
5.22.6 Error Messages ... 5-323
5.22.7 Applications ... 5-325
5.22.7.1 Siemens S7 Controller ... 5-325
5.22.7.1.1 Operating Mode 'Asynchronous' ... 5-325
5.22.7.1.2 Operating Mode 'Asynchronous with Synchronization Impulse' ... 5-325
5.22.7.1.3 Configuring the Operating Device as an INTERBUS Participant ... 5-326

5.22.7.1.4 Phoenix Contact Function Blocks ..... 5-326
5.22.7.1.5 FC20 (INIT_IB) ..... 5-327
5.22.7.1.6 FC21 (MEM_READ) ..... 5-331
5.22.7.1.7 FC22 (MEM_WRIT) ..... 5-332
5.22.7.1.8 FC28 (IB_SYNC) ..... 5-333
5.22.7.1.9 Function Blocks from Sütron electronic ..... 5-333
5.22.7.1.10 Decoding the Variable Number ..... 5-333
5.22.7.1.11 Overview of Function Blocks from Sütron electronic ..... 5-335
5.22.7.1.12 Inserting Sources and Function Blocks ..... 5-335
5.22.7.1.13 FC60 for the Operating Mode 'Asynchronous' with S7-400 ..... 5-337
5.22.7.1.14 FC66 for the Operating Mode 'Asynchronous' with S7-300 ..... 5-338
5.22.7.1.15 FC80 for the Operating Mode 'Asynchronous' with S7-400 ..... 5-339
5.22.7.1.16 FC86 for the Operating Mode 'Asynchronous' with S7-300 ..... 5-340
5.22.7.1.17 FC65 for the Operating Mode 'Asynchronous with Synchronization Impulse' with S7-300 ..... 5-341
5.22.7.1.18 FC85 for the Operating Mode 'Asynchronous with Synchronization Impulse' with S7-300 ..... 5-342
5.22.7.1.19 Example for the Operating Mode 'Asynchronous' ..... 5-342
5.22.7.1.20 Example for the Operating Mode 'Asynchronous with Synchronization Impulse' ..... 5-343

5.23 Modbus TCP ..... 5-345
5.23.1 Programming ..... 5-346
5.23.1.1 Protocol Parameters ..... 5-346
5.23.1.1.1 Controllers ..... 5-346
5.23.1.1.2 Maximum Waiting Time For Response ..... 5-346
5.23.1.1.3 Delay until Connection Set-Up ..... 5-346
5.23.1.1.4 Word Swap in Double-Word ..... 5-346
5.23.1.1.5 Use host name table from file ..... 5-347
5.23.1.1.6 Host Name Table ..... 5-347
5.23.1.2 Variable List ..... 5-347
5.23.1.3 System Parameters ..... 5-348
5.23.1.3.1 Poll Area ..... 5-348
5.23.2 Error Messages ..... 5-349

5.24 OMRON Host-Link ..... 5-351
5.24.1 Telegram Mode ..... 5-351
5.24.1.1 Point-to-Point Connection ..... 5-351
5.24.1.2 Multipoint Connection ..... 5-351
5.24.2 Data Types ..... 5-351
5.24.3 Programming ..... 5-353
5.24.3.1 Protocol Parameters ..... 5-353
5.24.3.1.1 Baud Rate ..... 5-353
5.24.3.1.2 Parity ..... 5-353
5.24.3.1.3 Handshake ..... 5-353
5.24.3.1.4 Data Bits ..... 5-354
5.24.3.1.5 Stop Bits ..... 5-354
5.24.3.1.6 Maximum Waiting Time For Response ..... 5-354
5.24.3.1.7 Delay until Connection Set-Up ..... 5-354
5.24.3.1.8 Mode ..... 5-354
5.24.3.2 Input Syntax ..... 5-355
5.24.3.3 System Parameters ..... 5-355
5.24.3.3.1 Poll Area ..... 5-355
5.24.3.3.2 Status Messages ..... 5-356
5.24.4 Physical Interfacing ..... 5-357
5.24.4.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-357
5.24.4.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-357

5.24.4.3 Cable X3 SER1 RS232 - OMRON Host-Link ... 5-358
5.24.4.4 Cable X2 RS232 - OMRON Host-Link ... 5-359
5.24.5 Error Messages ... 5-360
5.25 OMRON NT-Link ... 5-361
5.25.1 Telegram Mode ... 5-361
5.25.1.1 Point-to-Point Connection ... 5-361
5.25.1.2 Multipoint Connection ... 5-361
5.25.2 Data Types ... 5-361
5.25.3 Programming ... 5-364
5.25.3.1 Protocol Parameters ... 5-364
5.25.3.1.1 Baud Rate ... 5-364
5.25.3.1.2 Parity ... 5-364
5.25.3.1.3 Handshake ... 5-364
5.25.3.1.4 Data Bits ... 5-365
5.25.3.1.5 Stop Bits ... 5-365
5.25.3.1.6 Maximum Waiting Time For Response ... 5-365
5.25.3.1.7 Delay until Connection Set-Up ... 5-365
5.25.3.1.8 NT Module Number ... 5-366
5.25.3.1.9 Protocol Mode ... 5-366
5.25.3.1.10 Priority ... 5-366
5.25.3.1.11 Duplex Operation ... 5-366
5.25.3.1.12 PLC Type ... 5-367
5.25.3.2 Input Syntax ... 5-368
5.25.3.3 System Parameters ... 5-370
5.25.3.3.1 Poll Area ... 5-370
5.25.3.3.2 Status Messages ... 5-371
5.25.4 Physical Interfacing ... 5-372
5.25.4.1 Pin Assignment for Operating Devices with an Universal Interface ... 5-372
5.25.4.2 Pin Assignment for Operating Devices without an Universal Interface ... 5-372
5.25.4.3 Cable X3 SER1 RS232 - OMRON NT-Link ... 5-374
5.25.4.4 Cable X2 RS232 - OMRON NT-Link ... 5-375
5.25.4.5 Cable X3 SER1 RS485 - OMRON NT-Link 2-Wire ... 5-376
5.25.4.6 Cable X2 RS485 - OMRON NT-Link 2-Wire ... 5-377
5.25.4.7 Cable X3 SER1 RS485 - OMRON NT-Link 4-Wire ... 5-378
5.25.4.8 Cable X2 RS485 - OMRON NT-Link 4-Wire ... 5-379
5.25.5 Error Messages ... 5-380
5.26 Phoenix SSGI ... 5-381
5.26.1 Transfer of Process Variables ... 5-381
5.26.2 Programming ... 5-382
5.26.2.1 Protocol Parameters ... 5-382
5.26.2.1.1 Maximum Waiting Time For Response ... 5-382
5.26.2.1.2 Delay until Connection Set-Up ... 5-382
5.26.2.2 System Parameters ... 5-382
5.26.2.2.1 Poll Area ... 5-382
5.26.2.2.2 Status Messages ... 5-382
5.26.2.2.3 Data Set Transfer ... 5-382
5.26.2.3 Variables ... 5-383
5.26.2.3.1 Variable Types ... 5-383
5.26.2.4 Control Command Byte in DPRAM ... 5-383
5.26.2.5 Date and Time Addresses in DPRAM ... 5-384
5.26.2.6 Other Addresses in DPRAM ... 5-384
5.26.3 Physical Interfacing ... 5-385
5.26.4 Error Messages ... 5-386

5.27 ProComm plus ..... 5-387
5.27.1 Hardware ..... 5-387
5.27.2 Software ..... 5-387
5.27.3 Data Types ..... 5-387
5.27.3.1 Single Variables ..... 5-387
5.27.3.2 String Variables ..... 5-387
5.27.4 Programming ..... 5-388
5.27.4.1 Protocol Parameters ..... 5-388
5.27.4.1.1 Baud Rate ..... 5-388
5.27.4.1.2 Maximum Waiting Time For Response ..... 5-388
5.27.4.1.3 Delay until Connection Set-Up ..... 5-388
5.27.4.1.4 Path of the Variable List sr.csv ..... 5-388
5.27.4.2 System Parameters ..... 5-388
5.27.4.2.1 Poll Area ..... 5-388
5.27.4.2.2 Status Messages ..... 5-389
5.27.4.2.3 Date and Time ..... 5-389
5.27.4.2.4 Tables ..... 5-389
5.27.5 Physical Interfacing ..... 5-390
5.27.5.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-390
5.27.5.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-390
5.27.5.3 Cable X3 SER1 RS232 - Schleicher microLine ..... 5-391
5.27.5.4 Cable X2 RS232 - Schleicher microLine ..... 5-392
5.27.6 Error Messages ..... 5-393
5.28 PROFIBUS-DP ..... 5-395
5.28.1 Specification for PROFIBUS-DP ..... 5-395
5.28.1.1 Diagnosis ..... 5-395
5.28.2 Data Profile ..... 5-395
5.28.2.1 Structure of the Data Profile ..... 5-396
5.28.2.1.1 Request Telegram ..... 5-396
5.28.2.1.2 Response Telegram ..... 5-397
5.28.2.1.3 User Data ..... 5-397
5.28.2.1.4 Reading and Writing Bytes ..... 5-397
5.28.2.1.5 Reading Bits ..... 5-397
5.28.2.1.6 Writing Bits ..... 5-398
5.28.3 Programming ..... 5-399
5.28.3.1 Protocol Parameters ..... 5-399
5.28.3.1.1 Maximum Waiting Time For Response ..... 5-399
5.28.3.1.2 Delay until Connection Set-Up ..... 5-399
5.28.3.1.3 Station Number ..... 5-399
5.28.3.1.4 Telegram Length ..... 5-399
5.28.3.1.5 Floating Point Format ..... 5-399
5.28.3.1.6 Byte Order ..... 5-400
5.28.3.1.7 Adress Width ..... 5-400
5.28.3.2 System Parameters ..... 5-400
5.28.3.2.1 Poll Area ..... 5-400
5.28.4 Input Syntax ..... 5-401
5.28.5 Physical Interfacing ..... 5-402
5.28.5.1 Pin Assignment ..... 5-402
5.28.5.2 Cable X2 - PROFIBUS-DP ..... 5-402
5.28.5.2.1 Transfer Speed and Line Length ..... 5-403
5.28.6 Error Messages ..... 5-404
5.28.7 Applications ..... 5-406
5.28.7.1 Siemens S7 Controllers ..... 5-406

5.28.7.1.1 Hardware Configurator ... 5-406
5.28.7.1.2 PROFIBUS Function Blocks ... 5-409
5.28.7.1.3 Importing the STL Source Files ... 5-409
5.28.7.1.4 General Functioning ... 5-410
5.28.7.1.5 SFC14 Functioning ... 5-411
5.28.7.1.6 FC80 Functioning ... 5-412
5.28.7.1.7 SFC15 Functioning ... 5-412
5.28.7.1.8 Example for an OB1 ... 5-412
5.28.7.1.9 Defining Variables ... 5-413
5.28.7.2 Siemens S5 Controllers ... 5-413
5.28.7.2.1 Parameter Settings for IM308B ... 5-413
5.28.7.2.2 Data Consistency ... 5-414
5.28.7.2.3 PLC Program ... 5-414
5.28.7.2.4 FB110 Evaluation Block ... 5-415
5.28.7.2.5 FB111 - Reading from the Data Block ... 5-416
5.28.7.2.6 FB112 - Writing to the Data Block ... 5-416
5.28.7.2.7 Protocol Parameters for the Siemens S5 Series ... 5-417
5.28.7.2.8 Defining Variables ... 5-417
5.28.7.3 Rexroth Controllers ... 5-418
5.28.7.3.1 Configuration in WINSPS ... 5-418
5.28.7.3.2 Configuration in PROFI ... 5-421
5.28.7.3.3 Protocol Parameters for BM DP12 ... 5-424
5.28.7.3.4 Protocol Parameters for the Bosch CL Series ... 5-424
5.28.7.3.5 Defining Variables ... 5-424
5.29 Siemens S5 PG (AS511) ... 5-427
5.29.1 Data Types ... 5-427
5.29.2 Programming ... 5-430
5.29.2.1 Protocol Parameters ... 5-430
5.29.2.1.1 Baud Rate ... 5-430
5.29.2.1.2 Parity ... 5-430
5.29.2.1.3 Handshake ... 5-430
5.29.2.1.4 Data Bits ... 5-431
5.29.2.1.5 Stop Bits ... 5-431
5.29.2.1.6 Maximum Waiting Time For Response ... 5-431
5.29.2.1.7 Delay until Connection Set-Up ... 5-432
5.29.2.1.8 Fast Data Block Access ... 5-432
5.29.2.1.9 Input Syntax ... 5-433
5.29.3 Physical Interfacing ... 5-434
5.29.3.1 Pin Assignment for Operating Devices with an Universal Interface ... 5-434
5.29.3.2 Pin Assignment for Operating Devices without an Universal Interface ... 5-434
5.29.3.3 Cable X3 SER1 TTY / 20 mA - Siemens S5 PG ... 5-435
5.29.3.4 Cable X2 TTY / 20 mA - Siemens S5 PG ... 5-436
5.29.4 Error Messages ... 5-437
5.30 Siemens S7 MPI ... 5-439
5.30.1 Data Types ... 5-439
5.30.2 Programming ... 5-441
5.30.2.1 Protocol Parameters ... 5-441
5.30.2.1.1 Baud Rate ... 5-441
5.30.2.1.2 Delay until Connection Set-Up ... 5-441
5.30.2.1.3 Participant Address of Terminal ... 5-441
5.30.2.1.4 Highest Participant Address ... 5-442
5.30.2.1.5 Offline Operation ... 5-442
5.30.2.1.6 Connections ... 5-442
5.30.2.2 Input Syntax ... 5-443
5.30.2.3 System Parameters ... 5-443

5.30.2.3.1 Poll Area ..... 5-443
5.30.2.3.2 Status Messages ..... 5-444
5.30.3 Physical Interfacing ..... 5-445
5.30.3.1 Cable X2 - Siemens S7 MPI ..... 5-446
5.30.4 Error Messages ..... 5-447
5.31 Siemens S7 MPI (HMI adapter) ..... 5-449
5.31.1 Data Types ..... 5-449
5.31.2 Programming ..... 5-450
5.31.2.1 Protocol Parameters ..... 5-450
5.31.2.1.1 Baud Rate ..... 5-450
5.31.2.1.2 Delay until Connection Set-Up ..... 5-450
5.31.2.1.3 Participant Address of Terminal ..... 5-451
5.31.2.1.4 Highest Participant Address ..... 5-451
5.31.2.1.5 Connections ..... 5-451
5.31.2.2 Input Syntax ..... 5-452
5.31.2.3 System Parameters ..... 5-452
5.31.2.3.1 Poll Area ..... 5-452
5.31.2.3.2 Status Messages ..... 5-453
5.31.3 Physical Interfacing ..... 5-454
5.31.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-454
5.31.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-454
5.31.3.3 Cable X3 SER1 RS232 - Siemens S7 MPI (HMI adapter) ..... 5-455
5.31.3.4 Cable X2 RS232 - Siemens S7 MPI (HMI adapter) ..... 5-456
5.31.3.5 Cable X2 RS485 - Siemens S7 MPI (HMI adapter) ..... 5-457
5.31.4 Error Messages ..... 5-458
5.32 Siemens S7 PPI ..... 5-463
5.32.1 Data Types ..... 5-463
5.32.2 Programming ..... 5-464
5.32.2.1 Protocol Parameters ..... 5-464
5.32.2.1.1 Baud Rate ..... 5-464
5.32.2.1.2 Parity ..... 5-464
5.32.2.1.3 Handshake ..... 5-464
5.32.2.1.4 Data Bits ..... 5-465
5.32.2.1.5 Stop Bits ..... 5-465
5.32.2.1.6 Maximum Waiting Time For Response ..... 5-465
5.32.2.1.7 Delay until Connection Set-Up ..... 5-465
5.32.2.1.8 Station Number of the Terminal ..... 5-466
5.32.2.2 Input Syntax ..... 5-467
5.32.2.3 System Parameters ..... 5-468
5.32.2.3.1 Poll Area ..... 5-468
5.32.2.3.2 Status Messages ..... 5-468
5.32.3 Physical Interfacing ..... 5-469
5.32.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-469
5.32.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-469
5.32.3.3 Cable X3 SER1 RS485 - Siemens S7 PPI ..... 5-470
5.32.3.4 Cable X2 RS485 - Siemens S7 PPI ..... 5-471
5.32.3.5 Cable for Siemens S7 PPI Bus Connection ..... 5-472
5.32.4 Error Messages ..... 5-473
5.33 Sinec L1 Master ..... 5-475
5.33.1 Data Types ..... 5-475
5.33.2 Programming ..... 5-477
5.33.2.1 Protocol Parameters ..... 5-477

5.33.2.1.1 Baud Rate ..... 5-477
5.33.2.1.2 Parity ..... 5-477
5.33.2.1.3 Handshake ..... 5-477
5.33.2.1.4 Data Bits ..... 5-478
5.33.2.1.5 Stop Bits ..... 5-478
5.33.2.1.6 Maximum Waiting Time For Response ..... 5-478
5.33.2.1.7 Delay until Connection Set-Up ..... 5-478
5.33.2.1.8 Input Syntax ..... 5-479
5.33.2.1.9 Slave Number ..... 5-479
5.33.3 Physical Interfacing ..... 5-480
5.33.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-480
5.33.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-480
5.33.3.3 Cable X3 SER1 TTY / 20 mA - Sinec L1 ..... 5-481
5.33.3.4 Cable X2 TTY / 20 mA - Sinec L1 ..... 5-482
5.33.4 Error Messages ..... 5-483
5.33.5 Applications ..... 5-485
5.33.5.1 Connection to Simatic S5 95U and S5 115U ..... 5-486
5.33.5.1.1 Data Block L1DB ..... 5-486
5.33.5.1.2 Function Block FB200 (Initialization) ..... 5-486
5.33.5.1.3 Function Block FB201 (Communication) ..... 5-487
5.33.5.2 Connection to the Simatic S5 135U with CP530 ..... 5-488
5.33.5.2.1 Data Block L1DB ..... 5-488
5.33.5.2.2 Function Block FB200 (Initialization) ..... 5-488
5.33.5.2.3 Function Block FB201 (Communication) ..... 5-489
5.34 SUCOM1 PS306/316 ..... 5-491
5.34.1 Data Types ..... 5-491
5.34.2 Programming ..... 5-492
5.34.2.1 Protocol Parameters ..... 5-492
5.34.2.1.1 Baud Rate ..... 5-492
5.34.2.1.2 Parity ..... 5-492
5.34.2.1.3 Handshake ..... 5-492
5.34.2.1.4 Data Bits ..... 5-493
5.34.2.1.5 Stop Bits ..... 5-493
5.34.2.1.6 Swap LED Output ..... 5-493
5.34.2.2 Input Syntax ..... 5-494
5.34.3 Physical Interfacing ..... 5-495
5.34.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-495
5.34.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-495
5.34.3.3 Cable X3 SER1 RS485 - Moeller PS306 ..... 5-496
5.34.3.4 Cable X2 RS485 - Moeller PS306 ..... 5-497
5.34.3.5 Cable X3 SER1 RS485 - Moeller PS316/PS416 ..... 5-498
5.34.3.6 Cable X2 RS485 - Moeller PS316/PS416 ..... 5-499
5.34.4 Error Messages ..... 5-500
5.34.5 Applications ..... 5-501
5.34.5.1 Connection to PS416 ..... 5-501
5.34.5.1.1 Settings at the Controller ..... 5-501
5.34.5.1.2 Sucosoft S40 Manager ..... 5-502
5.35 SUCOM1 PS4-201 ..... 5-511
5.35.1 Data Types ..... 5-511
5.35.2 Programming ..... 5-512
5.35.2.1 Protocol Parameters ..... 5-512
5.35.2.1.1 Baud Rate ..... 5-512
5.35.2.1.2 Parity ..... 5-512

5.35.2.1.3 Handshake ..... 5-512
5.35.2.1.4 Data Bits ..... 5-513
5.35.2.1.5 Stop Bits ..... 5-513
5.35.2.1.6 Swap LED Output ..... 5-513
5.35.2.2 Input Syntax ..... 5-514
5.35.3 Physical Interfacing ..... 5-515
5.35.3.1 Pin Assignment for Operating Devices with an Universal Interface ..... 5-515
5.35.3.2 Pin Assignment for Operating Devices without an Universal Interface ..... 5-515
5.35.3.3 Cable X3 SER1 RS232 - Moeller PS4-201 ..... 5-516
5.35.3.4 Cable X2 RS232 - Moeller PS4201 ..... 5-517
5.35.4 Error Messages ..... 5-518
5.36 SUCOnet K ..... 5-519
5.36.1 Telegrams for the communication ..... 5-521
5.36.1.1 Telegram for Bit Access ..... 5-521
5.36.1.2 Telegram for Byte Access ..... 5-522
5.36.2 Data Types ..... 5-523
5.36.3 Programming ..... 5-524
5.36.3.1 Protocol Parameters ..... 5-524
5.36.3.1.1 Maximum Waiting Time For Response ..... 5-524
5.36.3.1.2 Delay until Connection Set-Up ..... 5-524
5.36.3.1.3 Slave Number ..... 5-524
5.36.3.1.4 Length of Data Telegram ..... 5-524
5.36.3.2 Input Syntax ..... 5-525
5.36.4 Physical Interfacing ..... 5-526
5.36.4.1 Pin Assignment ..... 5-526
5.36.4.2 Cable X2.1 X2.2 SUCOnet K ..... 5-527
5.36.5 Error Messages ..... 5-528

6 Shielding D-SUB Connectors ..... 6-1

A Table of Figures ..... A-1

B Table of Tables ..... B-1

C Index ..... C-1

# 1 Important Notes

## 1.1 Symbols

The symbols in this manual are used to draw your attention on notes and dangers.

### 1.1.1 General Symbols

**Danger**
This symbol is used to refer to instructions which, if ignored or not carefully followed could result in personal injury.

**Note**
This symbol indicates application tips or supplementary notes.

**Reference to source of information**
This symbol refers to detailed sources of information on the current topic.

### 1.1.2 Specific Symbols

The following symbols indicate specific dangers which could result in damage to equipment or personal injury or even up to the death of the operator.

**Danger - Electric Shock**

**Danger - Corrosive**

**Danger - Toxic**

**Danger - Explosive**

**Danger - Fire**

**Danger - Infrared Light**

**Danger - Electrostatic Charge**

## 1.2 Safety Notes

- Read this manual carefully before using the operating device. Keep this manual in a place where it is always accessible to all users.
- Proper transportation, handling and storage, placement and installation of this product are prerequisites for its subsequent flawless and safe operation.
- This user manual contains the most important information for the safe operation of the device.
- The user manual, in particular the safety notes, must be observed by all personnel working with the device.
- Observe the accident prevention rules and regulations that apply to the operating site.
- Installation and operation must only be carried out by qualified and trained personnel.

## 1.3 Intended Use

- The device is designed for use in the industry.
- The device is state-of-the art and has been built to the latest standard safety requirements. However, dangerous situations or damage to the machine itself or other property can arise from the use of this device.
- The device fulfills the requirements of the EMC directives and harmonized European standards. Any modifications to the system can influence the EMC behavior.

## 1.4 Target Group

All configuration and programming work in connection with the automation system must be performed by trained personnel only (e.g. qualified electricians, electrical engineers).

The configuration and programming personnel must be familiar with the safety concepts of automation technology.

# 2 Operating Concept

## 2.1 Introduction

With the term 'TesiMod', Sütron refers to the entire concept of operating and monitoring. A uniform functionality and operating structure constitute key aspects of this concept across the entire product family.

The devices of the TesiMod series relieve the controller completely of operating and monitoring tasks.

This applies to the operating mode Standard Mode in particular. In this mode, devices reach their full performance capacity. In this context, the device reads all required data independently from the controller, and processes this further internally. On request, the device writes data or data sets (of recipes) to the controller. The device independently controls the display and the status LEDs.

You can also run the devices as an ANSI terminal in the operating mode Transparent Mode. In this context, the device writes each key actuation to the controller as a press and release code. The controller uses escape sequences to control the display and the status LEDs of the device.

All devices of the TesiMod series are programmed with the same programming software TSwin.

### 2.1.1 Uniform device features

All devices of the TesiMod series are equipped with:

– Displays with temperature-compensated contrast or brightness control
– Flash memory
– Buffered RAM
– Real-time clock
– Watchdog timer
– Lithium battery with voltage monitoring
– An interface for downloads, uploads, the logging printer, a scanner
– Standard or field bus interfaces for communication with the controller
– a user mode switch.

All devices with a keyboard are additionally equipped with:

– Editing keys
– Control keys
– Function keys with status LEDs
– Slide-in identification strips for the function keys

The operating system of all TesiMod devices offers:

– the operating modes Standard Mode and Transparent Mode
– Application ID
– Multilingual applications
– Option to customize the interface parameters
– Automatic error correction
– Softkey functionality for all function keys
– A help system for masks and variables

- Password protection function for masks and variables
- Scaling of variable values
- Dynamic attributes for texts and variables
- A message system for status messages
- A message system for error messages
- Recipe data management function
- Print logs
- Operating hour meters
- System variables for internal functions.

Devices with graphics displays additionally offer:

- Use of any Windows fonts
- Display of images
- Display of sets of curves.

Devices with a touch screen additionally offer:

- Full-graphics user interface including buttons
- A keyboard that is shown automatically when a variable is selected

## 2.2 Programming TesiMod Operating Devices

All TesiMod operating devices are programmed in the same way with the TSwin programming software.

For this purpose, install the programming software on your PC.

– Start the software and select the corresponding entries for the device type and the desired communication protocol.
– Create all of the components of the project, consisting of languages and a controller.
– Compile the project into a S3 file and load the file into the operating device using the download cable.
– Connect the operating device to the controller or simulate the basic functions without a controller connected.

### 2.2.1 Hardware Prerequisites

To carry out the installation, you need a basic knowledge of Microsoft Windows. This information is not provided here. If you have any queries in this regard, refer to the Microsoft Windows manuals or online help.

**Hardware requirements for TSwin**

Your computer should fulfill at least the following hardware and software requirements, to run TSwin:

– Pentium processor with 100 MHz (preferably 266 MHz)
– 32 Mbyte working memory (RAM) (preferably 64 Mbyte)
– 100 Mbyte free hard disk memory
– CD ROM drive
– Mouse
– Windows NT 4, Windows 95, Windows 98, or Windows 2000
– One free serial interface

### 2.2.2 Installing TSwin

The installation of the programing software TSwin includes all required directories, files and entries in Windows.

TSwin runs under the operating systems Windows NT 4, Windows 95, Windows 98, Windows 2000, and Windows XP.

To install TSwin, insert the installation CD, select the desired language and start the installation process. Follow the instructions in the installation dialog box.

# 3 Standard Mode

TesiMod operating devices are usually used in the Standard Mode of operation. The devices deliver maximum performance in this mode.

## 3.1 Setting the Operating Mode

Make sure that you set the operating mode when the device is switched off. This ensures that the device accepts the new operating mode.

Note the switch positions ON and OFF marked on the user mode switch. Depending on the user mode switch, the position of the switches may vary.

The factory setting for all operating devices is the Standard Mode of operation. You use the user mode switch to set the operating mode.

Refer to the user manual for the device for more information on the position of the user mode switch.

After you switch on the power supply, the switch position is only read and evaluated once, that is, during the initialization phase.

To set the user mode switch with four switches to the operating mode **Standard Mode**:

Table 3-1 User mode switch with four switches set to Standard Mode

| Switch | Position |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | OFF |
| 4 | OFF |

To set the user mode switch with eight switches to the operating mode **Standard Mode**:

Table 3-2 User mode switch with eight switches set to Standard Mode

| Switch | Position |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | OFF |
| 4 | OFF |
| 5 | Not used |

Table 3-2 User mode switch with eight switches set to Standard Mode

| Switch | Position |
|---|---|
| 6 | Not used |
| 7 | Not used |
| 8 | Not used |

To set the user mode switch with four switches to the operating mode **Demo Mode**:

Table 3-3 User mode switch with four switches set to Demo Mode

| Switch | Position |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | ON |
| 4 | OFF |

To set the user mode switch with eight switches to the operating mode **Demo Mode**:

Table 3-4 User mode switch with eight switches set to Demo Mode

| Switch | Position |
|---|---|
| 1 | ON |
| 2 | OFF |
| 3 | ON |
| 4 | OFF |
| 5 | Not used |
| 6 | Not used |
| 7 | Not used |
| 8 | Not used |

## 3.2 Behavior of the Operating Device During Start-Up

### 3.2.1 With Valid Project

When you apply the supply voltage, all LEDs on the operating device are activated. A system test is then carried out, to check and initialize the modules in the operating device.

The system test may issue different system and error messages. If the device contains a valid project, the **start-up mask** or the mask entered as the start-up mask in the language parameter is displayed. This mask is displayed five seconds. This time is set as a fixed value. You can use this time to check whether the LEDs and the display are functioning correctly.

Once this time has expired, the main mask, or the mask set as the main mask in the language parameters, is displayed. This mask is also the first mask of user interface.

If the main mask contains a controller variable, and communication with the controller fails, an error message is displayed (instead of the main mask), which provides details about the communication error that occurred.

If you press the Enter key or similar button while the start-up mask is being displayed, the setup mask or the mask set in the language parameters is displayed. In this mask, for example, parameters are assigned to the interfaces. If you press any key before the start-up mask appears, an error message is generated when the keyboard is being checked. The error message includes the data for clock frequency, memory size, firmware level, protocol driver, programming software version, and the project name.

The display of the setup mask may be delayed if the message memory contains several messages of the serial message system. This is because time may be required to set up message management structures. However, this initialization time considerably reduces the time subsequently required to sort messages. A corresponding message is displayed during this time period.

### 3.2.2 Without a Valid Project

If no valid project exists, the Flash memory is erased, and the operating device automatically switches to the download operating mode.

The message 'DOWNLOAD 1' remains on the screen. This message indicates that the operating device is now ready to receive a valid project via the download interface. If no valid project is available in the memory, there is no communication with a connected controller, and the keyboard will not execute any functions.

## 3.3 Communication with a Controller

Communication between a controller (host computer, for example) and an operating device may occur in standard mode with any interface, except those for the logging printer and parallel outputs. The interface used always depends on the connected counterpart or on the network.

For more information on the interfaces themselves, see the manual for the corresponding operating device.

More detailed information is available on possible connections to different controllers and networks.
Siehe Kapitel „Steuerungs- und Busankopplungen“ auf Seite 5-1.

A standard cable, measuring about 3 m (9.843 ft), is available to ensure a secure connection for each connection option.

## 3.4 Masks

A mask refers to the content of a display page. This means that masks vary in size, depending on the operating device being used.

A mask corresponds to the screen displayed at a particular time on the screen of the operating device.

You can display and enter texts and variables (250) in input and output masks. You can determine the layout of these masks, and use images to tailor them to your specific requirements.

For each mask, you can program specific soft keys or function keys that will automatically link you to other masks. You can also program cursor keys to open other masks.

You can also program function keys to change the values of variables.

If you use the same mask names in all languages, you can use global mask elements to design similar masks. Global mask elements (for example, global variables) appear in each mask with the same name.

### 3.4.1 Mask Structure

Masks with specific functions form the basic components of the mask structure.

System masks:

– Setup mask
– Start-up mask
– Password mask
– Main mask

User mask:

– Input/output mask

The mask structure is made up of a network of input and output masks. There is no hierarchy. Input and output masks are located at nodes of the network. These masks contain a selection field from which you can choose the names of other masks.

In each input/output mask you can use control keys, function keys and but-

tons to access all other masks.

You can select different system masks for each language of a project.

### 3.4.2 Mask Parameters

Each mask parameter is valid for each individual mask of a project.

Mask parameters are:

- Mask number
- Access level
- Background color
- Help mask
- Variables management topdown
- Automatic data release
- Reset password
- Activate help mask

#### 3.4.2.1 Mask Number

You can use the mask number to:

- Enter masks in a text list and display as a mask menu
- Switch masks over from the controller
- Write documentation for masks

#### 3.4.2.2 Access Level

The access level corresponds to a threshold value for password management. You use it to determine when operators must enter a password.

Values between 0 and 255 are valid access level parameters.

The initial access level default value for each mask is 0. This corresponds to the status general release.

If the threshold value is above the view level, the operator can only display this mask if you enter the correct password.

If the threshold value is above the edit level, the operator can only change the variables contained in the mask if you enter the correct password.

#### 3.4.2.3 Background Color

For each mask, you can select a separate color for the entire mask area. All elements that may be contained in a mask cover over the background color!

You can only use this parameter for operating devices that use gray scales or color display.

#### 3.4.2.4 Help Mask

You can create a specific help mask for each mask, and display it by selecting the Help key or a corresponding button.

#### 3.4.2.5 Variables Management Topdown

If you activate this parameter, the variables in a mask are selected in sequence from top to bottom.

If this parameter is not activated, the variables are selected from left to right.

#### 3.4.2.6 Automatic Data Release

Switching to this mask automatically activates data release.

Otherwise you have to select the Data Release button to be able to change the value of a variable.

Automatic data release cannot be used with operating devices that use a touch screen.

#### 3.4.2.7 Reset Password

Exiting this mask reactivates password protection. When you go back to this mask, you must enter your password again.

#### 3.4.2.8 Activate Help Mask

If you are using a touch-screen operating device, you can select the unused display area to display the help mask.

You cannot use the 'Activate Help Mask' parameter for operating devices equipped with a keyboard.

### 3.4.3 System Masks

System masks are based on the input/output mask type. Some restrictions apply, due to the compulsory initialization phase and the fact that no communication has yet taken place with the controller.

System masks facilitate programming, and allow the system to become directly operable. In this way, the initialization phase becomes a fixed component of the project.

You can select any mask as the system mask.

As all masks are created on a language-specific basis, you can define other masks as system masks for each language.

As no communication has yet been established with the controller during the initialization phase, the following restrictions apply to system masks.

– The setup mask and start-up mask cannot be accessed by selecting a mask externally
– No controller variables can be displayed on the setup mask and start-up mask

## 3.4.3.1 Setup Mask

The operator can only access the operating device's setup mask if you select the Enter key or the Setup button during the initialization phase (the start-up mask is displayed for five seconds).

On the setup mask, it may be useful to include the following functions:

– Activate/deactivate download function
– Set protocol parameters
– Select PLC protocol
– Set date and time
– Display firmware level of the operating device

If you program these functions using system variables, the operator can select the corresponding parameter from text lists.

#### 3.4.3.1.1 Password Protection for Setup Mask

A special procedure applies to password protection on the setup mask.

If you set the system variable MskchgPasswd as the first editable variable on the setup mask, you can enter the password independently of the access level (exception 255). This also allows you to set password protection for the setup mask.

For the setup mask, the access level only impacts at the edit level, meaning the content is always visible to the operator.

#### 3.4.3.1.2 Suppressing the Setup Mask

You can choose to hide the setup mask if you do not need to display it.

To do this, set the access level for this mask to the value 255. The setup mask can then not be accessed from the start-up mask (using the Enter key or the Enter button).

## 3.4.3.2 Start-up Mask

The start-up mask appears for about five seconds after you switch on the operating device. This time is fixed, and this cannot be changed.

On the start-up mask, you can only display static texts and system variables. Due to the time sequence used, it is not possible to enter variables here.

When the start-up mask is being displayed, you can press the Enter key to go to the setup mask. You cannot go to the setup mask if the access level of

the setup mask is set to 255.

On the start-up mask, you can display the following information, for example:

– Service address
– Machine type
– Program version

### 3.4.3.3 Password Mask

In a project in which specific masks or variables are to be protected from unauthorized access, you must create a password mask.

In your password mask, you must create the system variable **MskchgPasswd**.

Select the name of the password mask in the language parameters, to activate the password mask.

You can create your own password mask for each language used in the project.

See chapter “Password Mask and Password Functions“ on page 3-127.
See chapter “MskChgPasswd“ on page 3-73.

### 3.4.4 Input/Output Masks

The user interface of a project is primarily made up of input and output masks. These masks may contain the following:

- Static text
- Text fields
- Variables
- System variables
- Background images
- Set of curves (graph)
- Buttons
- Recipe fields
- Table fields
- Message fields

You can also assign the following functions to an input/output mask:

- Sub-masks
- Help mask
- Background color
- Key functions (soft key function)

### 3.4.5 Help Masks

To optimize usability, you can create a help mask for each mask and each input variable. To call help on the operating devices, press the Help key or the button that has been programmed accordingly.

If data release is not requested, a help text appears for the screen. The help text for the variable that is currently selected appears, provided the Editor for entering a variable value has been activated.

The default help mask appears if no specific help mask has been linked to a mask or a variable.

A help mask is the same size as a normal mask. You can insert static text, background images, output variables, and tables in a help mask. You can also link help masks to sub-masks, to ensure that help masks have a uniform appearance.

See chapter “Password Mask and Password Functions“ on page 3-127.

## 3.5 Variables

All operating devices support standard usage variable types. The connected controller determines the number of variable types permitted.

The variable type determines the range of values and the number of significant places.

Table 3-5 Variable types

| Type | Size | Range of Values |
|---|---|---|
| Bit | 1 Bit | 0, 1 |
| Byte | 1 Byte | –128 to +127 |
| Byte | 1 Byte | 0 to 255 |
| Word | 2 Bytes | –32768 to +32767 |
| Word | 2 Bytes | 0 to 65535 |
| LWord | 4 Bytes | –2147483648 to +2147483647 |
| LWord | 4 Bytes | 0 to 4294967295 |
| LWord | 4 Bytes | ±1,2 x 10-38 to ±3,4 x 10+38 |
| ASCII | 42 Bytes | 0 to 255 |

In the programming software, you define a variable as a mask element. The mask element Variable is made up of the:

- Symbolic name
- Controller address
- Representation type
- Field type
- Field length
- Format
- Documentation value
- Limits
- Scaling
- Communication type
- Editor
- Variable type
- Attributes (static or dynamic)
- Character set
- Help mask

### 3.5.1 Symbolic Name

In the programming software, you assign a symbolic name to each variable. This name can have up to 255 characters.

## 3.5.2 Controller Address

You use the controller address to specify the storage location in the controller.

Note whether a variable will be accessed on a byte, word, or double-word basis.

Depending on the protocol selected, the system carries out a syntax check. To avoid incorrect input, you can call a syntax diagram for each protocol in the online help for the programming software.

## 3.5.3 Representation Type

You can choose from the following options for displaying variables on the operating device

- Decimal number
- Alphanumeric
- Selection text
- Selection image
- Floating point number
- Hexadecimal number
- Binary number
- Bars
- Curves

### 3.5.3.1 Decimal Number

This is the method most frequently used to display figures. You use this representation type for integers and fixed point numbers.

The programming software also distinguishes between:

- Standard
- Timer
- Counter
- BCD format

#### 3.5.3.1.1 Standard

The significance of the displayed digits increases from right to left. You can display places either with leading zeros and/or a decimal point. The representation refers to the data types bit, byte, word, and Lword. The maximum length depends on the data type. There are no blanks between the characters. The variable appears in the controller either in binary format or in special timer or counter formats.

**Example:** A decimal number with two decimal places.

| $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ | Significance |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | Displayed = 123,45 |

Table 3-6 Key functions for decimal numbers of the type Standard

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | 1st case: Variable is selected. The value is deleted and you can enter a new value.<br>2nd case: Cursor was moved within a positive value. The value is not changed.<br>3rd case: Cursor was moved within a negative value. The negative sign for the value is deleted. |
| Minus | 1st case: Variable is selected. The value is deleted, and a negative sign is inserted at the least-significant position. You can enter a new value.<br>2nd case: Cursor was moved within a positive value. A negative sign is placed in front of the value.<br>3rd case: Cursor was moved within a negative value. The value is not changed. |
| Delete | Deletes the position where the cursor is located, and also deletes the sign. |

#### 3.5.3.1.2 Timer

If the representation type Decimal Number is used as a timer, it only plays a significant role when used in combination with Siemens S5 controllers.

The type of formatting for the Timer variable type depends on the memory area from which the value is read.

If the value is read from a time word, the binary time value (10 bit) is offset with the time base (2 bit) so that the time value is calculated for the base 10 ms.

If the value is read from another memory area, it is assumed that the timer value is BCD-coded (three-digit BCD code and two-bit time base). This value is then also converted into a time value for the base 10 ms.

You can then format the resulting time value for the base 10 ms as a fixed point number. You can use fractional digits (decimal places) and scaling.

**Example:** On the operating device, you enter the setpoint value in the address MW100. The operating device displays the actual value from the address MW200. The input variables are formatted as follows:

| | |
|---|---|
| Representation type | Decimal number |
| Variable type | Timer |
| Field length | 7 |
| Fractional digits | 2 |
| Factor | 1 |
| Divisor | 1 |
| Addend | 0 |

The output variables are formatted as follows:

| | |
|---|---|
| Representation type | Decimal number |
| Variable type | Timer |
| Field length | 6 |
| Fractional digits | 1 |
| Factor | 1 |
| Divisor | 10 |
| Addend | 0 |

The command sequence

```
L MW 100SI T
```

loads the value from MW100 as a BCD-coded time value to the timer T1. The command sequence

```
LC T1T MW200
```

loads the current timer value into MW200. The operating device reads the value as a BCD-coded timer value and interprets it before it is output. The time value for the base 10 ms is produced and then scaled. In this example, the output values are displayed with one fractional digit (decimal place).

The following is displayed on the operating device.

Table 3-7 Example for timer values

| Input Value | Output Value | Resolu-tion | KT Value (S5) |
|---|---|---|---|
| 0000,01 to 0000,09 | 0000,0 to 0000,0 | 0,01 s | 001.0 to 009.0 |
| 0000,10 to 0000,99 | 0000,1 to 0000,9 | 0,01 s | 010.0 to 099.0 |
| 0001,00 to 0009,99 | 0001,0 to 0009,9 | 0,01 s | 100.0 to 999.0 |
| 0010,00 to 0099,90 | 0010,0 to 0099,9 | 0,1 s | 100.1 to 999.1 |
| 0100,00 to 0999,00 | 0100,0 to 0999,0 | 1 s | 100.2 to 999.2 |
| 1000,00 to 9990,0 | 1000,0 to 9990,0 | 10 s | 100.3 to 999.3 |

You can change the resolution, thereby modifying the input and reading accuracy, by changing the number of fractional digits and scaling.

Table 3-8 Key functions for decimal numbers of the type Timer

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |

Table 3-8 Key functions for decimal numbers of the type Timer

| Key | Function |
|---|---|
| Plus | 1st case: Variable is selected. The value is deleted and you can enter a new value.<br>2nd case: Cursor was moved within a positive value. The value is not changed.<br>3rd case: Cursor was moved within a negative value. The negative sign for the value is deleted. |
| Minus | 1st case: Variable is selected. The value is deleted, and a negative sign is inserted at the least-significant position. You can enter a new value.<br>2nd case: Cursor was moved within a positive value. A negative sign is placed in front of the value.<br>3rd case: Cursor was moved within a negative value. The value is not changed. |
| Delete | Deletes the position where the cursor is located, and also deletes the sign. |

#### 3.5.3.1.3 Counter

You can use the representation type Decimal Number as a counter only for controllers that support this type. The controller Siemens S5-115U is a sample case.

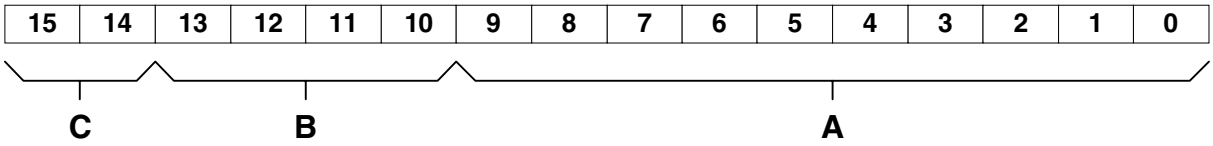



Figure 3-1 Structure of the counter word in Siemens S5-115U

A. Counter value binary-coded from 0 to 999
B. Edge trigger flag for setting, releasing, forwards and backwards counting
C. Help flag for queries

The type of formatting used by the variable type Counter depends on the memory area from which the value is read.

If the value is read from a count word, the binary counter value (10 bit) is directly transferred.

If the value is read from another memory area, it is assumed that the counter value is BCD-coded (three-digit BCD code). This value is also converted into a binary counter value.

You can then format the resulting counter value as an integer. This means that you can use scaling.

Table 3-9 Key functions for decimal numbers of the type Counter

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |

Table 3-9 Key functions for decimal numbers of the type Counter

| Key | Function |
|---|---|
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | 1st case: Variable is selected. The value is deleted and you can enter a new value.<br>2nd case: Cursor was moved within a positive value. The value is not changed.<br>3rd case: Cursor was moved within a negative value. The negative sign for the value is deleted. |
| Minus | 1st case: Variable is selected. The value is deleted, and a negative sign is inserted at the least-significant position. You can enter a new value.<br>2nd case: Cursor was moved within a positive value. A negative sign is placed in front of the value.<br>3rd case: Cursor was moved within a negative value. The value is not changed. |
| Delete | Deletes the position where the cursor is located, and also deletes the sign. |

#### 3.5.3.1.4 BCD Format

The significance of the displayed digits increases from right to left. You can display integers as BCD numbers with leading zeros.

The representation refers to the data types bit, byte, word, and Lword. The maximum length is 8 digits. There are no blanks between the characters. The variable appears in BCD format in the controller.

For one byte, the range of values spans from 00 to 99.

Example for a BCD number:

| $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ | Significance |
|---|---|---|---|---|---|---|
| 0 | 1 | 2 | 3 | 4 | 5 | Displayed = $1234_D$ |

It is important that you take particular care when inputting BCD numbers.

You can enter numeric values as standard decimal numbers using the Standard editor. You can also increment or decrement each individual digit of the BCD value using the Mixmode editor. You can only use the Increment editor to make incremental changes to individual digits in a value with decimal transfer. This corresponds to the procedure used by a decade switch.

For scaled variables, the value in the controller changes by +/- 1. However,

the value displayed also depends on the scaling specified.

Table 3-10 Key functions for decimal numbers of the type BCD

| Key | Function |
|---|---|
| 0 to 9 | 1. Standard and Mixmode - Enter the numbers 0 to 9<br>2. Increment - No function |
| Decimal point | Enters the decimal point. |
| Plus | 1. Standard - No function<br>2. Mixmode and Increment - Increments the value at the cursor and influences the more significant digits when the range of values is exceeded. |
| Minus | 1. Standard - No function<br>2. Mixmode and Increment - Decrements the value at the cursor and influences the more significant digits when the range of values is not reached. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Delete | 1. Standard and Mixmode - Variable is selected: The value is deleted and you can enter a new value.<br>2. Standard and Mixmode - Cursor was moved within the value: The character is deleted and the more significant digits are moved to the left.<br>3. Increment - No function |

### 3.5.3.2 Alphanumeric

For alphanumeric display, ASCII strings are read in byte format from the controller, and displayed in the operating device. The number of characters displayed varies, depending on the options offered by the operating device. A variable of the type Alphanumeric cannot be longer than one display line. Longer texts are truncated.

The controller address specifies the start of the string. It does not contain a length byte, as this is not required.

You can use the plus and minus keys to input alphanumeric characters. The system variables Shift and ShiftCase are also available for upper case (Shift) and lower case (ShiftCase) respectively. You can use these keys to enter the additional characters displayed on the numeric keys.

To use the system variables, link the system variables as press and release variables with a function key to the mask. During input, the operator must press the function key and the corresponding numeric key.

You can use the Password field type to enable concealed password entry on the operating device. However, you can only enter numbers here. An “X”

appears for each digit you enter.

See chapter “Password Protection“ on page 3-125.

Table 3-11 Key functions for alphanumeric variables

| Key | Function | With Shift | With Shift-Case |
|---|---|---|---|
| 0 | Enters the number 0 | ( ) ° 0 | ( ) ° 0 |
| 1 | Enters the number 1 | STU1 | STUstu1 |
| 2 | Enters the number 2 | VWX2 | VWXvwx2 |
| 3 | Enters the number 3 | YZ%3 | YZ%yz%3 |
| 4 | Enters the number 4 | JKL4 | JKLjkl4 |
| 5 | Enters the number 5 | MNO5 | MNOmno5 |
| 6 | Enters the number 6 | PQR6 | PQRpqr6 |
| 7 | Enters the number 7 | ABC7 | ABCabc7 |
| 8 | Enters the number 8 | DEF8 | DEFdef8 |
| 9 | Enters the number 9 | GHI9 | GHIghi9 |
| Decimal point | Enters the decimal point. | : ? ! . | :?!:?!. |
| Plus | Enters the numbers 0 to 9, the letters A to Z and a to z | <=>+ | <=><=>+ |
| Minus | Enters the numbers 0 to 9, the letters A to Z and a to z | \ * / – | */*/- |
| Cursor Right | Moves the cursor one position to the right. | | |
| Cursor Left | Moves the cursor one position to the left. | | |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. | | |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. | | |
| Delete | Deletes the character at the cursor position. | | |

### 3.5.3.3 Selection Text

You can choose to display a text instead of a numeric value. To do this, you must create a text list.

In the text list, you assign numeric values to the corresponding texts.

The operating device reads the value of the variable from the controller,

replaces the numeric value with text, and displays this text. If a value is read from the controller, and you have not defined a corresponding text for this value, the system displays a number of question marks.

If the Selection Text type is used for an input variable, you can choose to limit the field height to one or several lines.

If you specify a field height of 1, the system always only displays one text from the text list. If the field height is greater than 1, a correspondingly higher number of texts from the text list is displayed. The active text is displayed inversely.

Table 3-12 Key functions for selection texts

| Key | Function |
|---|---|
| 0-9 | No function |
| Decimal point | No function |
| Plus | Selection in ascending order (after the final value in the text list is reached, the value at top of the text list is selected next). |
| Minus | Selection in descending order (after the first value in the text list is reached, the value at the bottom of the text list is selected next). |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Delete | Deletes the character at the cursor position. |

### 3.5.3.4 Selection Image

You can choose to display images instead of numeric values, in the same way as you can use text to represent numeric values. In an image list, first of all assign individual images to the numeric values. The numeric values do not need to be contiguous or sorted consecutively. Then, in a mask create a variable field for the selection image variable. In the dialog field for the representation type Selection Image, link the variable with the image list. The corresponding image will then be displayed in the operating device, depending on the controller values used. The default image will be displayed for controller values that have not been specified in the image list.

Note that all of the images in an image list must be the same size, to ensure that they cover each other completely. Furthermore, make sure that the images used are not too large, to avoid slow display build-up. You may need

to modify the polling time accordingly.

Table 3-13 Key functions for selection images

| Key | Function |
|---|---|
| 0-9 | No function |
| Decimal point | No function |
| Plus | Selection in ascending order (after the final value in the image list is reached, the value at top of the image list is selected next). |
| Minus | Selection in descending order (after the first value in the image list is reached, the value at the bottom of the image list is selected next). |
| Cursor Right | No function |
| Cursor Left | No function |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Delete | No function |

### 3.5.3.5 Floating Point Number

The significance of the displayed digits increases from right to left. The number can optionally be displayed with a decimal point. Scaling is only carried out using a factor. The operating device can also form the inverse value before display.

There are no blanks between the characters. In the controller, the variable appears in special floating point formats, for example, IEEE. Only some controllers support floating point numbers.

Table 3-14 Key functions for floating point numbers

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | Enters the decimal point. |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |

Table 3-14 Key functions for floating point numbers

| Key | Function |
|---|---|
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | 1st case: Variable is selected. The value is deleted and you can enter a new value.<br>2nd case: Cursor was moved within a positive value. The value is not changed.<br>3rd case: Cursor was moved within a negative value. The negative sign for the value is deleted. |
| Minus | 1st case: Variable is selected. The value is deleted, and a negative sign is inserted at the least-significant position. You can enter a new value.<br>2nd case: Cursor was moved within a positive value. A negative sign is placed in front of the value.<br>3rd case: Cursor was moved within a negative value. The value is not changed. |
| Delete | Deletes the position where the cursor is located, and also deletes the sign. |

### 3.5.3.6 Hexadecimal Number

The significance of the displayed digits increases from right to left. Hexadecimal numbers are displayed with the digits 0 to 9 and A to F in upper case, and with leading zeros.

The representation refers to the data types byte, word, and LWord. The maximum length is 8 digits. There are no blanks between the characters.

**Example:** A hexadecimal number:

| $16^4$ | $16^3$ | $16^2$ | $16^1$ | $16^0$ | Significance |
|---|---|---|---|---|---|
| 0 | E | 4 | 5 | A | Displayed = 0E45AH |

Table 3-15 Key functions for hexadecimal numbers

| Key | Function |
|---|---|
| 0 to 9 | Enters the numbers 0 to 9. |
| Decimal point | No function |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |

Table 3-15 Key functions for hexadecimal numbers

| Key | Function |
|---|---|
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |
| Plus | Enters the characters 0 to 9 and A to F in ascending order. |
| Minus | Enters the characters 0 to 9 and A to F in descending order. |
| Delete | No function |

### 3.5.3.7 Binary Number

You use binary numbers to display individual bits, bytes, words, and Lwords. Select the number of bits and blank spaces for display. Both values are used to determine the entire field length.

There are a maximum of 32 bits for each variable. There can be no more than 255 blank spaces between the bits.

The significance of the displayed digits can be displayed in ascending order from either left to right or from right to left.

Example for displaying a binary number with or without blank spaces:

0 1 0 0 Blanks = 0

0 1 0 0 Blanks = 1

0 1 0 0 Blanks = 2

Table 3-16 Key functions for binary numbers

| Key | Function |
|---|---|
| 0 and 1 | Enters the numbers 0 and 1. |
| 2 to 9 | No function |
| Decimal point | No function |
| Cursor Right | Moves the cursor one position to the right. |
| Cursor Left | Moves the cursor one position to the left. |
| Cursor Up | Moves the cursor to the next highest, editable variable in the display, and selects it. If the cursor is already positioned at the top-level variable, the lowest-level variable is selected. |
| Cursor Down | Moves the cursor to the next lowest, editable variable in the display, and selects it. If the cursor is already positioned at the lowest-level variable, the top-level variable is selected. |

Table 3-16 Key functions for binary numbers

| Key | Function |
|---|---|
| Plus | Enters the characters 0 and 1. |
| Minus | Enters the characters 0 and 1. |
| Delete | No function |

### 3.5.3.8 Bars

You can use the representation type Bars only to output variable values.

The variable values are refreshed either cyclically or one time, when the mask is opened.

You use the height and width values to determine whether the bars run horizontally or vertically. From a particular reference point, the dimension of a bar can be:

– in a positive direction
– in a negative direction
– in both directions

Specify the width and height in the unit 'Character'. The entire bar can only ever accept the size of a multiple of a character. When the controller values are output, however, the bar changes its dimension by pixel size.

You use two values to define the range of values that a bar will display.

Use the first value to define:

– For BT25, the value of the bar on the right or top end
– For all other operating devices, the value of the bar on the left or bottom end

Use the second value to define:

– For BT25, the value of the bar on the left or bottom end
– For all other operating devices, the value of the bar on the right or top end.

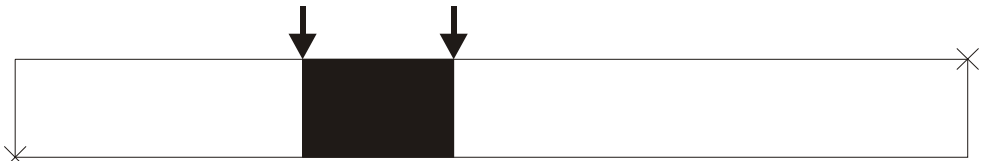


Figure 3-2 Horizontal bars

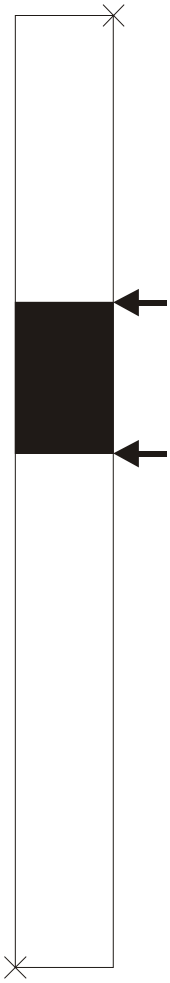


Figure 3-3 Vertical bars

The range of values is limited to values from -32768 to +32767.

To display several bars in a mask, ensure that the controller addresses are consecutive and contiguous. This will speed up data transfer.

You can use four fill patterns for bars:

1. For the empty area of the bar (background).
2. For the filled area of the bar (foreground).
3. For the bar, if the lower value is not reached.
4. For the bar, if the higher value is exceeded.

TSwin contains four standard fill patterns. You can use any other images as fill patterns. Prior to use, you must import these images into TSwin or insert them as OLE.

See chapter “Images“ on page 3-98.

**Example of fill status display:**

Four graphics have been created for the example. They display a container that is either empty or full. The word MIN is used to demonstrate a situation in which the value is not reached. And the word MAX to depict a situation in

which the value is exceeded. The container in the middle depicts a container for a case where the operating device displays a mid-point controller value for the variables.

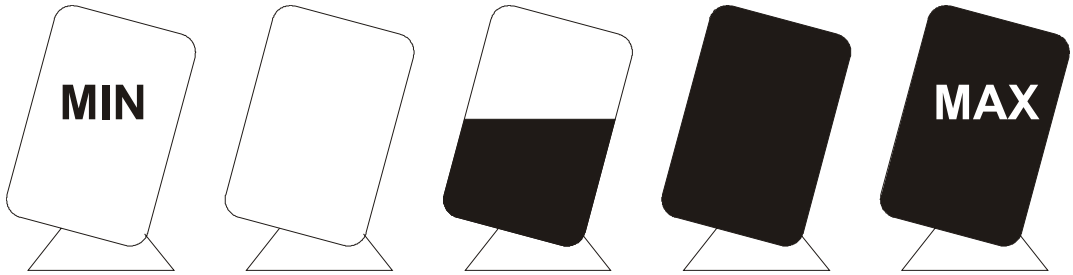



Figure 3-4 Example of fill status display

### 3.5.3.9 Curve

Use the representation type Curve to display a value table as a row of points in the operating device.

The address for the controller variable represents the start of the value table in the controller. Each value in the table describes one pixel of the curve.

A curve is defined by the following parameters:

– Maximum width (54 pixels for each curve variable)
– Maximum height (height of the display in the operating device)

Specify a length and height to determine the dimension of the curve in the unit 'Character'.

To produce a curve with a width of 54 pixels, several curve variables next to each other are required.

Insert a coordinate grid as a background image.

The operating device reads the variable values as an array from the controller, and inserts these as continuous consecutive height data. The value with the starting address (address +0) is displayed on the very left. Each subsequent piece of height data (address +n) is offset one pixel position to the right.

The height data for the curve is cyclically refreshed.

**Example of a curve display:**

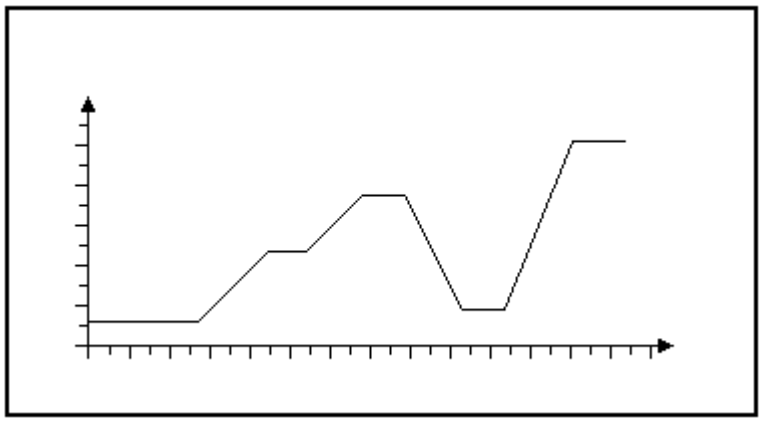


Figure 3-5 Example for displaying a curve

## 3.5.3.10 Fields

You can add fields to masks, to carry out specific tasks. Depending on the type of field added, the mask can be a message mask, recipe mask, or table mask. At runtime, you can display the messages sent by the PLC in the message field of a message mask. For a recipe mask, you must set up a recipe field to display the contents of a recipe. In the table field of a mask, data is displayed in tabular form.

#### 3.5.3.10.1 Message Field

The message field refers to the area in a mask that is used to display messages.

To create a message field, carry out the following steps:

1. Select the **Message Field** icon in the toolbar and in the mask select the area where messages will be displayed.

This area is displayed as a rectangle. The message field is marked with the letter M on the left edge of the rectangle.

2. You can use the sizing handles to change the height of the area. You cannot change the width of the area.
3. In the Message System area, determine whether messages of the parallel message system or the serial message system will be displayed in the current message field.

You can determine the height of the message field in the Height of Message Field area. A message field can have a maximum height of 60 lines.

In the Representation of Message area, you can specify data that can be changed when the operating device is running.

**Global settings:** If this parameter is active, default settings from the system parameters are used for the message system.

**Message group:** The system outputs the group identifier before the message text.

**Message number:** The system outputs the message number before the message text.

**Message date:** The system outputs today's date before the message text. In the date, the

year can either be output as two digits or four digits. The value of the date is frozen with the message.

**Time of message:** The system outputs the time before the message text. The value of the date is frozen with the message.

The maximum number of lines per message specifies that only the number of lines entered here will be displayed. The standard value is the maximum value of 255 lines.

In the Time Period area, you can specify the time period from which messages will be displayed.

**Chronicle:** The system displays all messages.

**Old list:** The system only displays acknowledged messages that do not have the status Disappeared.

In the Group Assignment area, you can select whether you would like to display message groups in the current message field, and if you would, specify the corresponding groups. Next to the group number, the system also displays the group identifier that you set up. Select the check box next to the group number, to select the required group. Any number of combinations are possible. If you do not select any check box, the system can display all groups.

The Font area specifies the character set used to display all elements of a message field on the operating device. To display all elements of a message field in another font, click the **New** button.

#### 3.5.3.10.2 Recipe Field

The Recipe field classifies the area in a mask used to display recipes.

Select the **Recipe Field** icon in the toolbar and in the mask select the area where recipes will be displayed. This area is displayed as a rectangle. The recipe field is marked with the letter R on the left edge of the rectangle. You can use the sizing handles to change the height of the area. You cannot change the width of the area.

Select the name of the recipe for which you want to set up a recipe field.

Just below, enter the height for the recipe field in the mask

The Font area specifies the character set used to display all elements of a recipe field on the operating device. To display all elements of a recipe field in another font, click the New Font button.

#### 3.5.3.10.3 Table Field

The Table field classifies the area in a mask used to display values in a table.

Select the **Table Field** icon in the toolbar and in the mask select the area where the table will be displayed. This area is displayed as a rectangle. The table field is marked with the letter T on the left edge of the rectangle. You can use the sizing handles to change the height of the area. You cannot change the width of the area.

Specify here, how many lines the table field will have and how many elements can be displayed in this table field.

The Font area specifies the character set used to display all elements of the table on the operating device. To display all elements of a table in another font, click the **New** button.

To display variable values in the table, create a variable frame in the table field. Specify the address for the variable and select the representation type.

Variables displayed in a button that has a frame cannot be dragged with the mouse to the table field. Frames of buttons cannot be displayed in tables.

**Example:** You have 256 elements you want to be displayed in a table which has four columns. The operating device has screen with 20 lines.16 of these lines are to be used to display elements. Therefore, create a table field with a height of 16. Enter 64 (16 lines x 4 elements) for the number of table elements.

## 3.5.4 Field Type

By selecting a field type, you determine whether the operator will be able to modify the variable's value or whether the value is just displayed.

For password entry, you can specify the field type in more detail.

### 3.5.4.1 Input

Select the field type Input to enable operators to change the value of a variable on the operating device.

The value of the variables is loaded from the controller when the mask is accessed.

If you select the attribute Cyclical, the system constantly updates the value of the variables, based on the interval specified in the polling time.

Before input, the operator must press the Data Release key. The operator can only change the value of the variables once the status LED for the data release is lit. Use the Enter key to write the value to the controller. The operator must then press the Data Release key. The status LED for the data release switches off.

### 3.5.4.2 Output

Select the field type Output to only display the value of the variables, but not allow the operator to change the value.

The value of the variables is loaded from the controller when the mask is accessed.

If you select the attribute Cyclical, the system constantly updates the value of the variables, based on the interval specified in the polling time.

### 3.5.4.3 Password

You can use the additional attribute Password to determine for an alphanumeric variable that the password is not visible on the operating device when it is entered.

Instead of displaying the values entered, the system displays the operator a string of “X“ when the password is entered.

### 3.5.4.4 Cyclical

The operating device always polls the controller for the value of a variable when the operator goes to a mask in which a value is to be displayed. However, to display actual values, the value must be continuously updated. Therefore, always select the field type Cyclical for displaying actual values.

The system will then continuously update the value of the variables, based on the interval set as the polling time.

## 3.5.5 Format

### 3.5.5.1 Only Positive

Use the attribute Only Positive to display variable values that are to be displayed without a sign. This means that the range of values that can be displayed changes, for example, for a byte, from between -128 and +127 to between 0 and 255.

You can also display positive decimal numbers with leading zeros.

### 3.5.5.2 Display Leading Zeros

For positive decimal numbers, you can display more significant digits with a value of zero as zeros.

**For example:** If the field length is 5 digits, the number 25 is displayed with leading zeros as follows:

00025

### 3.5.5.3 Field Length

The field length of a variable is made up of:

- The sign
- The number of digits
- The decimal point

For the representation type Binary Number, the number of blank spaces is added to the number of digits, to determine the field length.

### 3.5.5.4 Fractional Digits

You can define the number of fractional digits for decimal and floating point numbers.

This does not change the field length, however, one digit for displaying the decimal point is lost.

## 3.5.6 Documentation Value

The documentation value for displaying a variable is a placeholder when you program with TSwin. Depending on the representation type you are using, TSwin specifies another documentation value, for example, 'F' for hexadecimal numbers or '9' for decimal numbers.

The documentation value is also used for project documentation instead of a real controller value.

See chapter “Documentation“ on page 3-180.

## 3.5.7 Limits

In the programming software, you can specify a lower and an upper limit for each variable to restrict operator input.

The lower limit is automatically set to 0 for variable values that are displayed with the attribute Only Positive.

If the operator tries to enter a value outside of these limits, one of the following system messages is issued:

– Value too small
– Value too large

The operator can ignore these system messages, but he must enter a value that lies between the limits, or use the Cursor Up or Cursor Down keys to go to another variable in the mask. The system then accepts the current controller value again.

## 3.5.8 Scaling

### 3.5.8.1 Scaled Input

To modify the values that the operator enters in the operating device in line with the values used in the connected controller, inverse scaling must be carried out.

The system uses the following formula to scale the input:

$$\text{Controller Value} = \frac{\text{Input Value of the Unit} - \text{Summand}}{\text{Factor}} \times \text{Divisor}$$

Figure 3-6 Scaling of the input variables in the operating device

A rounding error may occur during scaling which is calculated using the following formula.

$$\left(\boxed{\text{Input Value of the Unit}} \times \text{Factor}\right) < \left(\text{Upper Limit} - \text{Divisor} / 2\right)$$

Figure 3-7 Rounding of the input variables in the operating device

### 3.5.8.2 Scaled Output

You can scale output to modify the range of values to suit user interface requirements. The scaling data is used for both output and input in the operating device. This does not restrict the range of values for the variable. Scaling is only carried out in the operating device.

You use the following operands for scaling:

– Factor,
– Divisor and
– Addend.

Note that a factor or divisor with the value 0 is not permitted.

Table 3-17 Scaling decimal numbers

| Operand | Range of Values |
|---|---|
| Factor | –32768 to –1, +1 to +32767 |
| Divisor | +1 to +32767 |
| Addend | –32768 to +32767 |

Table 3-18 Scaling floating point numbers

| Operand | Range of Values |
|---|---|
| Factor | –999999999,99999999 to –0,00000001+0,00000001 to +999999999,99999999 |
| Divisor | –999999999,99999999 to –0,00000001+0,00000001 to +999999999,99999999 |
| Addend | –999999999,99999999 to +999999999,99999999 |

The operating device uses the following formula to scale the output:

$$\text{Output Value of the Unit} = \frac{\text{Controller Value} \times \text{Factor}}{\text{Divisor}} + \text{Summand}$$

Figure 3-8 Scaling of the output variables in the operating device

Use the following formula to determine the operands.

$$\frac{\text{Current Controller Value} - \text{Lower Limit Controller Values}}{\text{Current Terminal Value} - \text{Lower Limit Output Values}} = \frac{\text{Upper Limit Controller Values} - \text{Lower Limit Controller Values}}{\text{Upper Limit Output Values} - \text{Lower Limit Output Values}}$$

Figure 3-9 Scaling of the output variables

The following example will help you determine the operands.

**Example:**

Range of values for output values:
Lower limit for output value = 0
Upper limit for output value = 100
Current value in operating device = x

Range of values for controller values:
Lower limit for controller values = -4096
Upper limit for controller values = 4096
Current controller value = y

1. Inserting the variable values:

$$\frac{y - (-4096)}{x - 0} = \frac{4096 - (-4096)}{100 - 0}$$

$$\frac{y + 4096}{x} = \frac{4096 + 4096}{100}$$

Figure 3-10 Inserting the variable values in the formula

2. Solving the equation:

$$100\,y + 409600 = 8192\,x$$

Figure 3-11 Solving the equation

3. Solving the equation for x:

$$x = \frac{100}{8192}\,y + \frac{409600}{8192}$$

$$x = \frac{\boxed{100}}{\boxed{8192}}\,y + \boxed{50}$$

Factor
Summand
Divisor

Figure 3-12 Solving the equation for x

## 3.5.9 Communication Definition

### 3.5.9.1 PLC Handshake

Select the attribute PLC Handshake to inform the controller that the values of the **subsequent controller variables of the current mask** are to be changed.

To do this, you must:

– Create a variable for the Read Coordination byte AND
– Create a variable for the polling area

See chapter “Read Coordination Byte“ on page 3-108.
See chapter “Write Coordination Byte“ on page 3-110.

The attribute PLC Handshake allows you to:

– Create your own recipe management system
– Inform the controller that a specific variable value will be changed

The PLC handshake process runs as follows:

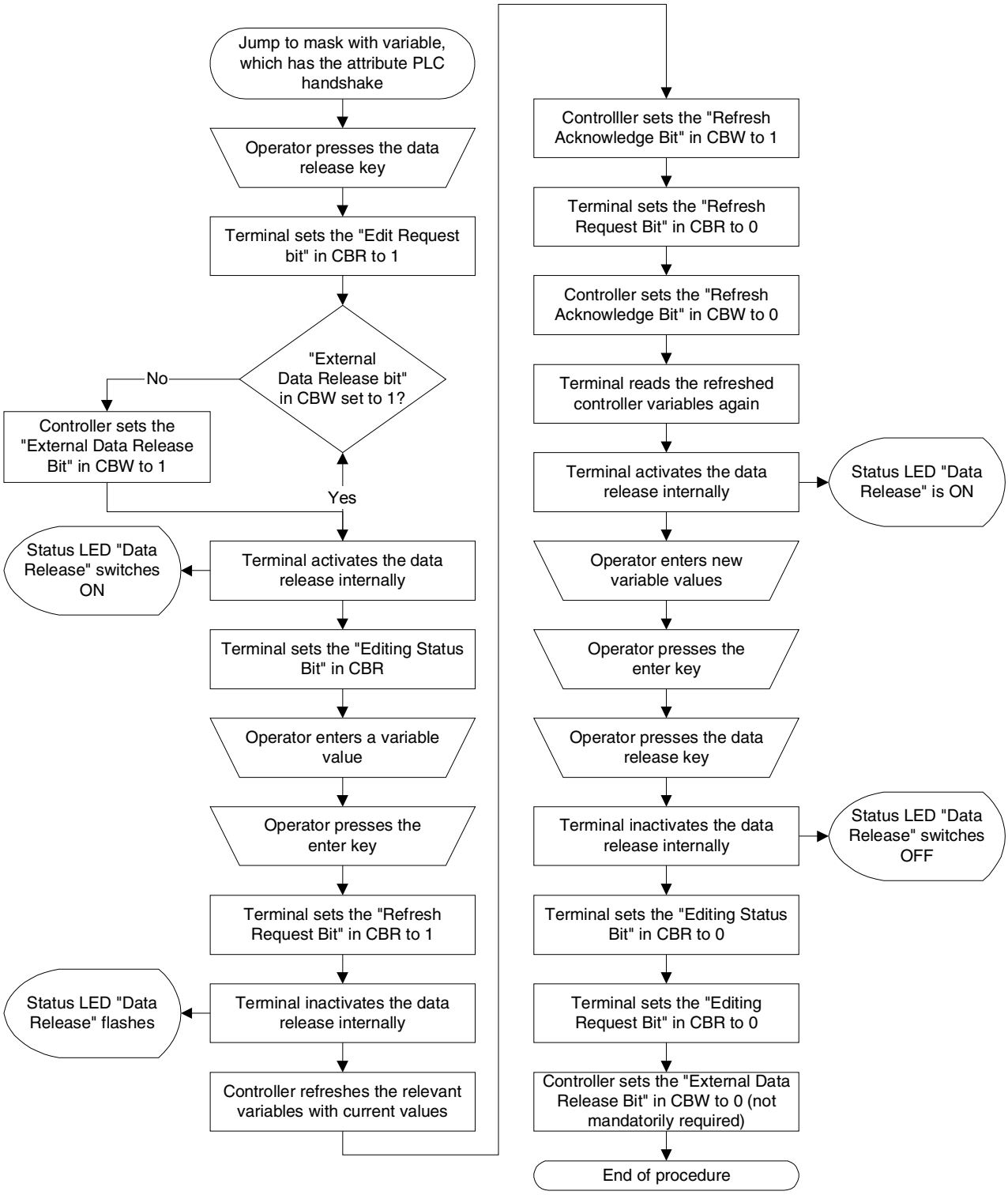

Jump to mask with variable, which has the attribute PLC handshake
Operator presses the data release key
Terminal sets the "Edit Request bit" in CBR to 1
"External Data Release bit" in CBW set to 1?
No
Controller sets the "External Data Release Bit" in CBW to 1
Yes
Status LED "Data Release" switches ON
Terminal activates the data release internally
Terminal sets the "Editing Status Bit" in CBR
Operator enters a variable value
Operator presses the enter key
Terminal sets the "Refresh Request Bit" in CBR to 1
Status LED "Data Release" flashes
Terminal inactivates the data release internally
Controller refreshes the relevant variables with current values
Controlller sets the "Refresh Acknowledge Bit" in CBW to 1
Terminal sets the "Refresh Request Bit" in CBR to 0
Controller sets the "Refresh Acknowledge Bit" in CBW to 0
Terminal reads the refreshed controller variables again
Terminal activates the data release internally
Status LED "Data Release" is ON
Operator enters new variable values
Operator presses the enter key
Operator presses the data release key
Terminal inactivates the data release internally
Status LED "Data Release" switches OFF
Terminal sets the "Editing Status Bit" in CBR to 0
Terminal sets the "Editing Request Bit" in CBR to 0
Controller sets the "External Data Release Bit" in CBW to 0 (not mandatorily required)
End of procedure

Figure 3-13 Flow diagram for PLC handshake

### 3.5.9.2 With Enter

The operator must press the Enter key to transfer the value of the variables from the operating device to the controller.

### 3.5.9.3 With +, –, or Enter

Each time the operator presses the Plus and Minus keys, he transfers the incremented or decremented value to the controller. If the operator uses the 0 to 9 keys to enter the value, he must then press the Enter key.

### 3.5.9.4 For all changes

The operator can change the value of a variable only with the Plus and Minus keys. The changed value is transferred to the controller each time you select the Plus and Minus keys.

## 3.5.10 Access Type

### 3.5.10.1 Normal

Use the access type Regular for accessing selection text, or selection image variables for projects that do not use any variant options. The system then displays for selection all entries in a text list or an image list.

### 3.5.10.2 Selective

Use the access type Selective to only display the selection texts or selection images that are “released“ using a controller variable. Each bit of the controller variable represents an entry in the text or image list.

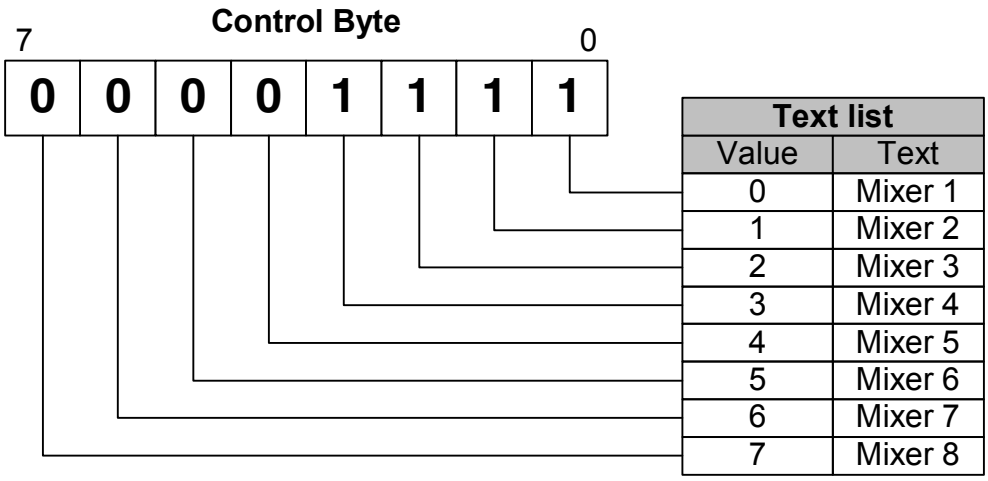



Figure 3-14 Selective access

You can use the control byte depicted in the Selective Access image to only display the first four entries in the text list.

The controller variable is only read once, when the operating device is being initialized!

Enter the name of the controller variable in the Variant Buffer field of the

Variant Option dialog box.

### 3.5.10.3 Article Administration

This function is reserved.

### 3.5.10.4 Delete Article Administration

This function is reserved.

## 3.5.11 Variable Type

### 3.5.11.1 Standard

The standard type is the variable type most frequently used to display decimal numbers. The maximum length depends on the data type. The significance of the displayed digits increases from right to left. There are no blanks between the digits.

| Significance | $10^3$ | $10^2$ | $10^1$ | $10^0$ | $10^{-1}$ | $10^{-2}$ |
|---|---|---|---|---|---|---|
| Displayed 123,45D | 0 | 1 | 2 | 3 | 4 | 5 |

### 3.5.11.2 Timer

The variable type Timer only plays a significant role when used with Simatic S5 controllers. The interpretation of the variable value depends on the memory area from which it is read.

| Timer Word | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Content | | | Time Base | | | | Timer Value, Binary Coded | | | | | | | | | |

| EW, AW, DW, MW | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Content | | | Time Base | | Timer Value, BCD Coded | | | | | | | | | | | |

The time values with the time base are converted to time values for a base of 10 ms. This time value is displayed by the operating device using the formatting selected.

### 3.5.11.3 Counter

You can use the variable type Counter only with controllers that also support

this type in the form outlined here.

| Counter word | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Con-tent | Auxil-iary Flag | | Edge Trigger Flag | | | | Timer Value, Binary Coded | | | | | | | | | |

| EW, AW, DW, MW | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bit | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Con-tent | | | | | Count Value, BCD Coded | | | | | | | | | | | |

The system directly accepts the counter value from a counter word. The counter values from other memory areas are converted from BCD to a binary value. The operating device displays the resulting integer in the selected format.

### 3.5.11.4 BCD Number

A BCD number must be saved in the controller in BCD format. The operating device can interpret and display up to eight digits. The significance of the displayed digits increases from right to left. There are no blanks between the digits. The value can be displayed with leading zeros.

| Significance | $10^4$ | $10^3$ | $10^2$ | $10^1$ | $10^0$ |
|---|---|---|---|---|---|
| Displayed 1234D | 0 | 1 | 2 | 3 | 4 |

## 3.5.12 Attributes (Static or Dynamic)

### 3.5.12.1 Global

Variables with the attribute Global:

- Appear in all languages for a project
- Appear in all masks with the same name
- Appear in the same position

If you change the parameters of these variables, the changes apply to all masks with the same name and to all languages for the project.

### 3.5.12.2 Inverse

Variables with the attribute **Inverse** are displayed so that the foreground and background colors are swapped.

### 3.5.12.3 Flashing

Variables with the attribute **Flashing** are displayed so that the foreground and background colors change at specific intervals. The attribute Flashing cannot be displayed in TSwin. The result only appears in the operating device.

### 3.5.12.4 Underline

Variables with the attribute **Underline** are displayed with a line under the entire variable value.

### 3.5.12.5 Invisible

The attribute **Invisible** is only evaluated together with a control variable. In all other cases, the attribute **Invisible** results in an error message during compilation, and no S3 file is generated.

Static texts and one-off variables (variables that are output only once) with the attribute **Invisible** are not output.

Cyclical variables with the attribute **Invisible** are overwritten with blanks. This erases any existing obsolete value on the screen.

If background images and cyclical variables are being used simultaneously, the background image is not updated!

Regarding input variables, note that the operator cannot enter the range of values for the attribute **Invisible**. If an input value is in the area of the attribute **Invisible**, the edit process is not started. The operator then has no possibility to change the value again.

### 3.5.12.6 Non-Editable

The **Non-editable** attribute selectively prevents variable values from being changed. The system then only outputs the variable value one-off or cyclically.

You can only use the **Non-Editable** attribute in conjunction with a control variable.

## 3.5.13 Font

The Font attribute determines the font in which the characters are displayed in a mask.

Note:

- Only some operating devices can display fonts up to any size.
- The names of the fonts cannot be changed.

– You can select a separate font for each static text in a mask.
– The system displays all messages using the same font.
– The system displays all elements in a recipe using the same font.

## 3.5.14 Help Mask

To optimize usability, you can create a help mask for all masks and all variables. To call this help mask in the operating device, press the **Help** key or a corresponding button.

On operating devices equipped with a keyboard, the help mask is only displayed for as long as you keep the **Help** key pressed.

A help mask is the same size as a standard mask. You can insert static text, background images, output variables, and tables in a help mask. You can also link help masks to sub-masks, to ensure that help masks have a uniform appearance.

If a mask or variable is not linked with a help mask, only the default help mask is displayed. You can also design the default help mask to suit your own needs.

The help text for a mask is displayed until data release is requested. Otherwise the help is displayed for the variable that is currently being edited.

## 3.5.15 Output Variables

Output variables are numeric or alphanumeric memory content from the connected controller. The variable values are requested from the controller if required, and displayed at the program location using the corresponding representation type.

### 3.5.15.1 One-Off and Cyclical Output Variables

Pure output variables are transferred once from the controller when the mask is being called-up, and are displayed in the mask. Outputting the variable only once helps improve communication performance, and can be used for all variables, such as setpoint values, constants, and parameters that rarely or never change. All output variables can be displayed as scaled or formatted.

Cyclical output variables are used to display actual values and values that continuously change while a mask is being output.

You specify the cycle time with the polling time. This means that you know at this stage how often the display of the actual values will be refreshed.

To improve the performance of transfer to the controller, use data types identically and ensure that the address ranges of a mask are as continuous as possible.

The scaling and formatting of cyclical output variables, in particular of deci-

mal numbers as floating point numbers, requires a corresponding computing time, and as a result the data is not output in real time.

For these applications, select cycle times > 500 ms.

The more cyclical data is transferred, the longer the reaction time to new values from the controller.

### 3.5.15.2 Formatted Output

You can format a numeric variable value to suit an output area.

Formatting consists of:

- Field Length
- Fractional Digits
- Positive Values Only
- Display Leading Zeros

The field length determines the entire length of the output value, including signs, decimal points, and fractional digits.

The number of fractional digits gives the operator the impression that a value has been divided, however, in reality no value has been divided. However, the variable value must exist in the controller in a correspondingly high resolution.

**Example:**

In the controller, the value of a length is stored as a word.The range of values is between 0 and 65535. The following settings are made for display:

- Decimal number
- Output
- Only positive
- Field length = 6 (5 + decimal point)
- Fractional digits = 2 (absolute)

The display area is between 0,00 and 655,35. If the check box Only Positive is not selected, the display area changes. The value is displayed with a sign. You must specify an additional position in the field length for the sign. The following data is required:

- Decimal number
- Output
- Field length = 7 (5 + decimal point + sign)
- Fractional digits = 2 (absolute)

The display range is then between –327.68 and +327.67.

## 3.5.16 Input Variables

When displaying input variables for the first time in the operating device, the system uses the same approach as for one-off output variables (output variables that are output only once). This also applies to scaling, which works

from the controller's viewpoint.

Input variables are processed by editors in the operating device.

### 3.5.16.1 Plausibility Check

The system carries out a plausibility check for all input variables. During this check, it compares the value entered with the range limits stored in the variable list.

If the limits are not adhered to, the system issues one of the following system messages:

– 'Value too large' or
– 'Value too small'

The incorrect value is not written to the controller. If an error occurs, the previously valid value is retained.

To prevent the above-mentioned system messages from appearing, you must delete them in the programming software. When you do this, the following applies:

– If the value is exceeded, the value of the upper limit is entered
– If the value is not reached, the value of the lower limit is entered

## 3.5.17 System Variables

You can use system variables to control the operating device's internal functions.

You can display and change the value of system variables either in a mask or using any suitable representation type, function or soft key.

When you link a system variable with a function key or soft key, the following rules apply:

– Do not use the same key to link a mask change and a system variable.
– You do not have to link Set (1) and Reset (0) with the same key, except if you are setting up a jogging mode.

Do not add the names of system variables to the variable list! In the same way as you use the name of a system variable for a controller variable, the function is lost for the operating device.

## 3.5.17.1 Basic Functions

#### 3.5.17.1.1 IntEraseEprom

| | | |
|---|---|---|
| Function | | Deletes the project from the Flash memory and places the operating device into the download mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Deletes the project |

#### 3.5.17.1.2 MainVersion

| | | |
|---|---|---|
| Function | | Displays the current firmware version. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric, field length = 8 |
| Configurable values | | Format determined by the manufacturer. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

#### 3.5.17.1.3 ComVersion

| | | |
|---|---|---|
| Function | | Displays the type and version number of the current protocol. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric, field length = 8 |
| Configurable values | | Format determined by the manufacturer. |

#### 3.5.17.1.4 UserVersion

| | | |
|---|---|---|
| Function | | Displays the project's version number. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | 0 to 255 |

#### 3.5.17.1.5 Boot

| | | |
|---|---|---|
| Function | | Boots the operating device (system restart). |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Boot |

#### 3.5.17.1.6 LcdContrast

| | | |
|---|---|---|
| Function | | Sets the contrast of LC displays. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | Depends on the operating device type. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

Adhere to the values for the upper and lower limits, as specified in the user manual for the relevant operating device.

#### 3.5.17.1.7 LcdBackground

| | | |
|---|---|---|
| Function | | Displays masks in inverted format on operating devices equipped with a LC display. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Not inverted |
| | 1 | Inverted |

#### 3.5.17.1.8 LcdBackLight

| | | |
|---|---|---|
| Function | | Brightness of the backlighting of LC displays. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | Depends on the operating device type. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

Adhere to the values for the upper and lower limits, as specified in the user manual for the relevant operating device.

#### 3.5.17.1.9 TurnOnTemp

| | | |
|---|---|---|
| Function | | Temperature value at which the display is automatically switched on. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Display OFF |
| | 1 | Display ON |

#### 3.5.17.1.10 OsLanguage

| | | |
|---|---|---|
| Function | | For multilingual projects, this variable is used for online language selection. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | First language |
| | N | n–th language |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

#### 3.5.17.1.11 IdentName

| | | |
|---|---|---|
| Function | | Displays the name of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 13 characters |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

#### 3.5.17.1.12 IdentVersion

| | | |
|---|---|---|
| Function | | Displays the version of the current project (application ID). |

| | | |
|---|---|---|
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 5 characters |

#### 3.5.17.1.13 IdentDate

| | | |
|---|---|---|
| Function | | Displays the date of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 6 characters |

#### 3.5.17.1.14 IdentTime

| | | |
|---|---|---|
| Function | | Displays the time of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 6 characters |

#### 3.5.17.1.15 IdentCount

| | | |
|---|---|---|
| Function | | Displays the counter value of the current project (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 4 characters |

#### 3.5.17.1.16 IdentRandom

| | | |
|---|---|---|
| Function | | Displays the current project's ending (application ID). |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Max. 2 characters |

#### 3.5.17.1.17 ComErrorRetry

| | | |
|---|---|---|
| Function | | Displays the number of communication errors. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to n | Number of communication errors |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

## 3.5.17.2 Communication SER1

#### 3.5.17.2.1 ComDataLenA

| | | |
|---|---|---|
| Function | | Sets the number of data bits for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 5 Bit |
| | 1 | 6 Bit |
| | 2 | 7 Bit |
| | 3 | 8 Bit |

#### 3.5.17.2.2 ComParityA

| | | |
|---|---|---|
| Function | | Sets the parity for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No parity |
| | 1 | Odd parity |
| | 2 | Even parity |

#### 3.5.17.2.3 ComStopBitsA

| | | |
|---|---|---|
| Function | | Sets the number of stop bits for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 1 Bit |
| | 1 | 1,5 Bit |
| | 2 | 2 Bit |

#### 3.5.17.2.4 ComBaudrateA

| | | |
|---|---|---|
| Function | | Sets the baud rate for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 300 Baud |
| | 1 | 600 Baud |
| | 2 | 1200 Baud |
| | 3 | 2400 Baud |
| | 4 | 4800 Baud |
| | 5 | 9600 Baud |
| | 6 | 19200 Baud |
| | 7 | 38400 Baud |
| | 8 | 57600 Baud (operating devices with 386 CPU only) |

#### 3.5.17.2.5 ComHandshakeA

| | | |
|---|---|---|
| Function | | Sets the handshake method for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No handshake |
| | 1 | Hardware handshake (RTS/CTS) |
| | 2 | Software handshake (XON/XOFF) |

#### 3.5.17.2.6 ComDefaultA

| | | |
|---|---|---|
| Function | | Activates the interface parameters for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Activates the interface parameters entered by the operator. |
| | 2 | Activates the interface parameters that were specified in the programming software. |

#### 3.5.17.2.7 ComTimeout

| | | |
|---|---|---|
| Function | | Sets the timeout watchdog time for SER1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No timeout watchdog (Initial state) |
| | 1 to 65535 | Timeout watchdog time in ms |

#### 3.5.17.2.8 ComRetryTimeout

| | | |
|---|---|---|
| Function | | Sets the waiting time (delay) after which another connection setup is attempted for SER1. This time period allows to span the time period required for the PLC-specific power-up phase, thereby preventing error messages from being generated. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Waiting time in ms |

#### 3.5.17.2.9 ComSlaveNr

| | | |
|---|---|---|
| Function | | Sets the slave number for an operating device connected to a network. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | Slave number |

#### 3.5.17.2.10 ComErrorCode

| | | |
|---|---|---|
| Function | | Displays the last error code issued for a COMMUNICATION, SYSTEM, or FATAL error. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 99999 | |

For all CP devices from Phoenix Contact:

| | | |
|---|---|---|
| Function | | Displays the last error code (high word) issued for a COMMUNICATION, SYSTEM, or FATAL error. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 | 0x00002032 = 256 Kbytes0x00003230 = 768 Kbytes |
| | 2 | 0x43503135 = CP215 IB0x43503232 = CP222 IB |
| | 3 | --- |
| | 4 | Checksum for the CP2xx |

By inserting this system variable into the message text of a message, the error code will be stored in the message memory in addition to the message. See chapter “Serial Message System“ on page 3-159.

#### 3.5.17.2.11 ComErrorSubcode

| | | |
|---|---|---|
| Function | | Displays the last error subcode (low word) issued for a COMMUNICATION, SYSTEM, or FATAL error. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 99999 | |

By inserting this system variable into the message text of a message, the error code will be stored in the message memory in addition to the message. See chapter “Serial Message System“ on page 3-159.

## 3.5.17.3 Error Statistics SER1

#### 3.5.17.3.1 ComParityCount

| | | |
|---|---|---|
| Function | | Displays the number of parity errors for SER1. Is deleted at every download. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Number of parity errors |

#### 3.5.17.3.2 ComOverrunCount

| | | |
|---|---|---|
| Function | | Displays the number of overrun errors. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Number of overrun errors |

#### 3.5.17.3.3 ComFrameCount

| | | |
|---|---|---|
| Function | | Displays the number of framing errors. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 65535 | Number of framing errors |

## 3.5.17.4 Communication SER2

#### 3.5.17.4.1 ComDataLenB

| | | |
|---|---|---|
| Function | | Sets the number of data bits for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 5 Bit |
| | 1 | 6 Bit |
| | 2 | 7 Bit |
| | 3 | 8 Bit |

#### 3.5.17.4.2 ComParityB

| | | |
|---|---|---|
| Function | | Sets the parity for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No parity |
| | 1 | Odd parity |
| | 2 | Even parity |

#### 3.5.17.4.3 ComStopBitsB

| | | |
|---|---|---|
| Function | | Sets the number of stop bits for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 1 Bit |
| | 1 | 1,5 Bit |
| | 2 | 2 Bit |

#### 3.5.17.4.4 ComBaudrateB

| | | |
|---|---|---|
| Function | | Sets the baud rate for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | 300 Baud |
| | 1 | 600 Baud |
| | 2 | 1200 Baud |
| | 3 | 2400 Baud |
| | 4 | 4800 Baud |
| | 5 | 9600 Baud |
| | 6 | 19200 Baud |
| | 7 | 38400 Baud |
| | 8 | 57600 Baud (operating devices with 386 CPU only) |

#### 3.5.17.4.5 ComHandshakeB

| | | |
|---|---|---|
| Function | | Sets the handshake for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No handshake |
| | 1 | Hardware handshake (RTS/CTS) |
| | 2 | Software handshake (XON/XOFF) |

#### 3.5.17.4.6 ComDefaultB

| | | |
|---|---|---|
| Function | | Activates the interface parameters for SER2. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |

| | | |
|---|---|---|
| Configurable values | 0 | Inactive |
| | 1 | Activates the interface parameters entered by the operator. |
| | 2 | Activates the interface parameters that were specified in the programming software. |

## 3.5.17.5 Real-Time Clock

The values for the real-time clock can be set from the operating device and from the controller.
See chapter “Date and Time Image“ on page 3-128.

#### 3.5.17.5.1 RTCSec

| | | |
|---|---|---|
| Function | | Sets the seconds of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 to 59 | Seconds |

#### 3.5.17.5.2 RTCMin

| | | |
|---|---|---|
| Function | | Sets the minutes of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 to 59 | Minutes |

#### 3.5.17.5.3 RTCHour

| | | |
|---|---|---|
| Function | | Sets the hours of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 to 23 | Hours |

#### 3.5.17.5.4 RTCDay

| | | |
|---|---|---|
| Function | | Sets the day of the date for the real-time clock. |

| | | |
|---|---|---|
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 31 | Number of days depends on the month. Invalid settings are corrected by the real-time clock next time when the date changes. |

#### 3.5.17.5.5 RTCMonth

| | | |
|---|---|---|
| Function | | Sets the month of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 12 | |

#### 3.5.17.5.6 RTCYear

| | | |
|---|---|---|
| Function | | Sets the year of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 99 | Only the year and decade are influenced. |

#### 3.5.17.5.7 RTCDayOfWeek

| | | |
|---|---|---|
| Function | | Sets the day of the week of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 6 | Only for operating devices with TMP Z84 CPU or RISC–CPU |
| | 1 to 7 | Only for operating devices with 386 CPU |

#### 3.5.17.5.8 RTCDateFmt

| | | |
|---|---|---|
| Function | | Sets the date format for the message output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Europe DD MM YY |
| | 1 | USA MM DD YY |
| | 2 | Japan YY MM DD |

#### 3.5.17.5.9 RTCYear2000

| | | |
|---|---|---|
| Function | | Sets a 4-digit year of the real-time clock. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 9999 | |

## 3.5.17.6 Serial Message System

### 3.5.17.6.1 RepmanSortCrit

| | | |
|---|---|---|
| Function | | Defines the sorting criteria for message output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | By priority of message number |
| | 1 | In order of arrival (most recent first) |
| | 2 | In order of arrival (oldest first) |
| | 3 | By group |

### 3.5.17.6.2 ClearRepBuf

| | | |
|---|---|---|
| Function | | Erases the memory for the serial messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Delete all messages from the message memory |
| | 2 | Delete only the acknowledged messages from the message memory |

### 3.5.17.6.3 RepmanRepPrint

| | | |
|---|---|---|
| Function | | Is used to have messages output to a printer. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Formatted output, the interface is used permanently. |
| | 2 | Complete output, the interface is used permanently. |
| | 3 | Formatted output, the interface is used temporarily. |
| | 4 | Complete output, the interface is used temporarily. |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

If you use the interface permanently for message output, it will not be possible to send any other print jobs to the printer.

If you use the interface temporarily for message output, messages will not be printed while other print jobs are being printed.

#### 3.5.17.6.4 RepoutNr

| | | |
|---|---|---|
| Function | | Allows you to output a message number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.6.5 RepoutDate

| | | |
|---|---|---|
| Function | | Allows you to output the date along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.6.6 RepoutTime

| | | |
|---|---|---|
| Function | | Allows you to output the time along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.6.7 RepoutAnzYear

| | | |
|---|---|---|
| Function | | Specifies how the date appears when the message is output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Year with 2 digits |
| | 1 | Year with 4 digits |

#### 3.5.17.6.8 RepoutRepText

| | | |
|---|---|---|
| Function | | Displays the most recent serial message. The message is displayed in accordance with the specified representation settings. |

| | | |
|---|---|---|
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.9 Repout RepText21

| | | |
|---|---|---|
| Function | | Displays the most recent serial message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.10 RepoutRepText41

| | | |
|---|---|---|
| Function | | Displays the most recent serial message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.11 RepoutRepText61

| | | |
|---|---|---|
| Function | | Displays the most recent serial message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.12 RepmanQuitKey

| | | |
|---|---|---|
| Function | | Simulates the function of the Acknowledge key. |
| Data type | | Numeric |

| | | |
|---|---|---|
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Function of the Acknowledge key active |

You must edit the value of this variable with a function key or a button. You cannot use any other input form.

#### 3.5.17.6.13 RepmanChgMask

| | | |
|---|---|---|
| Function | | Lets you jump to the mask which is linked with the selected message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |

You must edit the value of this variable with a function key or a button. You cannot use any other input form.

#### 3.5.17.6.14 RepoutQuitText

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

If the operator acknowledges the displayed message, the system automatically displays the next unacknowledged message.

#### 3.5.17.6.15 RepoutQuitText21

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.16 RepoutQuitText41

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.17 RepoutQuitText61

| | | |
|---|---|---|
| Function | | Displays the most recent unacknowledged serial message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.6.18 RepoutQuitAnz

| | | |
|---|---|---|
| Function | | Displays the number of messages that still need to be acknowledged. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | |

#### 3.5.17.6.19 RepoutMarker

| | | |
|---|---|---|
| Function | | Indicates the current position of the messages within the message box. |
| Data type | | Numeric |
| Representation type | | Decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number, bar |
| Configurable values | 0 | The message with the highest priority is visible. |
| | 1 | Neither the message with the highest priority nor the message with the lowest priority is visible. |
| | 2 | The message with the lowest priority is visible. |
| | 3 | The message with the highest priority and the message with the lowest priority is visible. |
| | 4 | No message is visible within the message box. |

#### 3.5.17.6.20 RepoutSelectGroup

| | | |
|---|---|---|
| Function | | Sets the group numbers whose messages are displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0x01h to 0x80h | Group number 1 to 8 |

Each group is represented by one bit of a byte. A logical '1' in bit 0 activates group1, in bit 1 activates group2 and so on.

The settings for a message field override the settings for this system variable! To prevent the settings in the operating device from being overridden, you must activate the Global Settings function for the message field.

#### 3.5.17.6.21 RepoutSelectTime

| | | |
|---|---|---|
| Function | | Specifies the time rule according to which messages are displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 | All messages in chronological order. |
| | 2 | All acknowledged messages that do not have the attribute "Disappear". |
| | 3 | All messages that do not have the attribute "Acknowledged". |

#### 3.5.17.6.22 RepoutGroup

| | | |
|---|---|---|
| Function | | Allows you to output a group number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

## 3.5.17.7 Parallel Message System

#### 3.5.17.7.1 RepmanSortCritP

| | | |
|---|---|---|
| Function | | Defines the sorting criteria for message output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |

| | | |
|---|---|---|
| Configurable values | 0 | By priority of message number |
| | 1 | In order of arrival (most recent first) |
| | 2 | In order of arrival (oldest first) |

The value of the variable is stored retentively. The stored value is automatically used again after a power failure.

#### 3.5.17.7.2 RepoutNrP

| | | |
|---|---|---|
| Function | | Allows you to output a message number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.7.3 RepoutDateP

| | | |
|---|---|---|
| Function | | Allows you to output the date along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.7.4 RepoutTimeP

| | | |
|---|---|---|
| Function | | Allows you to output the time along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.7.5 RepoutAnzYearP

| | | |
|---|---|---|
| Function | | Specifies how the date appears when the message is output. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Year with 2 digits |
| | 1 | Year with 4 digits |

#### 3.5.17.7.6 RepoutRepTextP

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.7.7 Repout RepText21P

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.7.8 RepoutRepText41P

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.7.9 RepoutRepText61P

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.7.10 RepoutSelectGroupP

| | | |
|---|---|---|
| Function | | Sets the group numbers whose messages are displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 256 | |

Each group is represented by one bit of a byte. A logical '1' in bit 0 activates group1, in bit 1 activates group2 and so on.

The settings for a message field override the settings for this system variable! To prevent the settings in the operating device from being overridden, you must activate the Global Settings function for the message field.

#### 3.5.17.7.11 RepoutGroupP

| | | |
|---|---|---|
| Function | | Allows you to output a group number along with the message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

## 3.5.17.8 Printer Control

#### 3.5.17.8.1 StopPrint

| | | |
|---|---|---|
| Function | | Stops the current print process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Stops the print process. |

#### 3.5.17.8.2 BlockPrint

| | | |
|---|---|---|
| Function | | Starts to print the selected messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the print process. |

#### 3.5.17.8.3 PrintAllRep

| | | |
|---|---|---|
| Function | | Starts to print all of the serial messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts printing using the current formatting. |
| | 2 | Starts printing using all of the formatting options. |

#### 3.5.17.8.4 PrintAllState

| | | |
|---|---|---|
| Function | | Starts to print all parallel messages. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the print process. |

#### 3.5.17.8.5 BlockPrintLong

| | | |
|---|---|---|
| Function | | Starts printing the selected messages using all of the formatting options. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the print process. |

## 3.5.17.9 Menu Control / Keys

#### 3.5.17.9.1 NewMask

| | | |
|---|---|---|
| Function | | Changes to the mask with the indicated number. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 9999 | Mask number |

#### 3.5.17.9.2 VarTablenR0

| | | |
|---|---|---|
| Function | | Creates a continuous numbering in tables, beginning with 0. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to n | |

#### 3.5.17.9.3 VarTablenR1

| | | |
|---|---|---|
| Function | | Creates a continuous numbering in tables, beginning with 1. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to n | |

#### 3.5.17.9.4 HardCopy

| | | |
|---|---|---|
| Function | | Loads the current mask image from the operating device to the PC. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Start upload |

This system variable applies only to operating devices with a Z80-CPU with a firmware release **older** than version 6.3 (Hx00063x).

Connect the PC to the operating device using the download cable before starting the upload. Use a terminal program like e.g. HyperTerminal©.

#### 3.5.17.9.5 TabLeft

| | | |
|---|---|---|
| Function | | Is used to move to the left column of a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Move to left column |

#### 3.5.17.9.6 TabRight

| | | |
|---|---|---|
| Function | | Is used to move to the right column of a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Move to right column |

#### 3.5.17.9.7 TabPgUp

| | | |
|---|---|---|
| Function | | Is used to page up within a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Page up |

#### 3.5.17.9.8 TabPgDn

| | | |
|---|---|---|
| Function | | Is used to page down within a table. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Page down |

#### 3.5.17.9.9 Shift

| | | |
|---|---|---|
| Function | | Enables alphanumerical character input. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state, only numerical input possible |
| | 1 | Upper-case alphanumerical character input enabled |
| | | |
| Key | | Letters (Characters) |
| 0 | | ( ) ° 0 |
| 1 | | S T U 1 |
| 2 | | V W X 2 |
| 3 | | Y Z % 3 |
| 4 | | J K L 4 |

| | | |
|---|---|---|
| 5 | | M N O 5 |
| 6 | | P Q R 6 |
| 7 | | A B C 7 |
| 8 | | D E F 8 |
| 9 | | G H I 9 |
| Decimal point | | : ? ! . |
| Plus | | < = > + |
| Minus | | \ * / – |

#### 3.5.17.9.10 ShiftCase

| | | |
|---|---|---|
| Function | | Enables alphanumerical character input. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state, only numerical input possible |
| | 1 | Upper case and lower case alphanumerical character input enabled |
| | | |
| Key | | Letters (Characters) |
| 0 | | ( ) ° 0 |
| 1 | | S T U s t u 1 |
| 2 | | V W X v w x 2 |
| 3 | | Y Z % y x % 3 |
| 4 | | J K L j k l 4 |
| 5 | | M N O m n o 5 |
| 6 | | P Q R p q r 6 |
| 7 | | A B C a b c 7 |
| 8 | | D E F d e f 8 |
| 9 | | G H I g h i 9 |
| Decimal point | | : ? ! . |
| Plus | | < = > + |
| Minus | | \ * / – |

#### 3.5.17.9.11 ShiftTouch

| | | |
|---|---|---|
| Function | | Displays the state of the shift mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | OFF |
| | 1 | ON |

#### 3.5.17.9.12 KeyCursLeft

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Left key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Left active |

#### 3.5.17.9.13 KeyCursRight

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Right key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Right active |

#### 3.5.17.9.14 KeyCursUp

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Up key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Up active |

#### 3.5.17.9.15 KeyCursDown

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Down key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Down active |

#### 3.5.17.9.16 KeyHome

| | | |
|---|---|---|
| Function | | Simulates the key function of the Cursor Home key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Cursor Home active |

#### 3.5.17.9.17 KeyHelp

| | | |
|---|---|---|
| Function | | Simulates the key function of the Help key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Help active |

#### 3.5.17.9.18 KeyDot

| | | |
|---|---|---|
| Function | | Simulates the key function of the Decimal Point key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Decimal Point active |

#### 3.5.17.9.19 KeyClear

| | | |
|---|---|---|
| Function | | Simulates the key function of the Clear key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Clear active |

#### 3.5.17.9.20 Key0

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '0'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 0 active |

#### 3.5.17.9.21 Key1

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '1'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 1 active |

#### 3.5.17.9.22 Key2

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '2'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 2 active |

#### 3.5.17.9.23 Key3

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '3'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 3 active |

#### 3.5.17.9.24 Key4

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '4'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 4 active |

#### 3.5.17.9.25 Key5

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '5'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 5 active |

#### 3.5.17.9.26 Key6

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '6'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 6 active |

#### 3.5.17.9.27 Key7

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '7'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 7 active |

#### 3.5.17.9.28 Key8

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '8'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 8 active |

#### 3.5.17.9.29 Key9

| | | |
|---|---|---|
| Function | | Simulates the key function of the key '9'. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function 9 active |

#### 3.5.17.9.30 KeyPlus

| | | |
|---|---|---|
| Function | | Simulates the key function of the Plus key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Plus active |

#### 3.5.17.9.31 KeyMinus

| | | |
|---|---|---|
| Function | | Simulates the key function of the Minus key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Minus active |

#### 3.5.17.9.32 KeyEnter

| | | |
|---|---|---|
| Function | | Simulates the key function of the Enter key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Enter active |

#### 3.5.17.9.33 KeyEdit

| | | |
|---|---|---|
| Function | | Simulates the key function of the Data Release key. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Key function Edit active |

## 3.5.17.10 Password

#### 3.5.17.10.1 MskChgPasswd

| | | |
|---|---|---|
| Function | | Variable for password input. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | 11 characters |

#### 3.5.17.10.2 MskChgResPasswd

| | | |
|---|---|---|
| Function | | Deletes the currently entered passwordand resets the access authorization. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Delete password and reset access authorization |

#### 3.5.17.10.3 ChangePasswd

| | | |
|---|---|---|
| Function | | Changes a password. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | 11 characters |

#### 3.5.17.10.4 FlashPasswd

| | | |
|---|---|---|
| Function | | Resets the passwords to the values specified in the TSwin. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Reset passwords |

Before you use this system variable, make sure to save the password with the highest-level access authorizations!

#### 3.5.17.10.5 PasswdInactive

| | | |
|---|---|---|
| Function | | Deactivates password protection. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Password protection active, inactive during initial initialization |
| | 1 | Password protection active, edit and view level = 255 |

The value of the system variable is stored retentively. The stored value is automatically used again after a power failure.

#### 3.5.17.10.6 ActViewLevel

| | | |
|---|---|---|
| Function | | Displays the current view level. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

#### 3.5.17.10.7 ActEditLevel

| | | |
|---|---|---|
| Function | | Displays the current edit level. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

## 3.5.17.11 Recipes

#### 3.5.17.11.1 SelectDSNr

| | | |
|---|---|---|
| Function | | Number of the current data set. |
| Data type | | Numeric |
| Representation type | | Selection text, decimal number |
| Configurable values | 0 to 250 | |

#### 3.5.17.11.2 SelectDSName

| | | |
|---|---|---|
| Function | | Name of the current data set. |
| Data type | | Alphanumeric |
| Representation type | | Selection Text |
| Configurable values | | 30 characters |

#### 3.5.17.11.3 DestDSNr

| | | |
|---|---|---|
| Function | | Number of the destination data set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 250 | |

#### 3.5.17.11.4 DSCopy

| | | |
|---|---|---|
| Function | | Copies the current data set to the destination indicated in DestDSNr. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Copy to destination in DestDSNr |
| | 2 | Automatically copy and search a free data set |
| | 3 | Copy to destination in DestDSNr and overwrite any data set existing |

#### 3.5.17.11.5 DSDelete

| | | |
|---|---|---|
| Function | | Deletes the current data set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Deletes the active data set and activates the first data set of the recipe. |
| | 2 | Deletes all data sets of the current recipe and activates the default data set of the recipe. |

#### 3.5.17.11.6 ActDSName

| | | |
|---|---|---|
| Function | | Name of the current data set. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | 30 characters |

#### 3.5.17.11.7 SelectRezeptNr

| | | |
|---|---|---|
| Function | | Number of the currently active recipe. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | |

You can only enter the numbers of existing recipes. Invalid entries are ignored

#### 3.5.17.11.8 SelectRezeptName

| | | |
|---|---|---|
| Function | | Name of the current recipe. |
| Data type | | Numeric |
| Representation type | | Alphanumeric |
| Configurable values | | TSwin provides the texts automatically (30 characters). |

You can only select the names of existing recipes. TSwin automatically generates a text list with the names of existing recipes and links it to this system variable.

#### 3.5.17.11.9 DSDeleteState

| | | |
|---|---|---|
| Function | | Displays the status of the data set delete process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Delete inactive |
| | 1 | Delete active (the current data set of the current recipe is deleted) |

#### 3.5.17.11.10 LoadRezName

| | | |
|---|---|---|
| Function | | Name of the last recipe transferred. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Up to 30 characters<br>If the recipe was deleted after being transferred, a number of question marks '????' are displayed instead of the name. |

#### 3.5.17.11.11 DSDownload

| | | |
|---|---|---|
| Function | | Loads the current data set to the controller. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Loads the content of the recipe buffer to the controller. |
| | 2 | Loads the content of the single variable to the controller. |

#### 3.5.17.11.12 DSDnloadBreak

| | | |
|---|---|---|
| Function | | Ends the data set transfer currently in progress. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Stop data set transfer |

#### 3.5.17.11.13 DSDnloadState

| | | |
|---|---|---|
| Function | | Displays the status of the data set transfer to the controller. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |

| | | |
|---|---|---|
| Configurable values | 0 | Inactive |
| | 1 | Data set transfer is requested, but not yet released by the controller. |
| | 2 | Data set transfer in progress |

#### 3.5.17.11.14 LoadDSName

| | | |
|---|---|---|
| Function | | Name of the last data set transferred. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Up to 30 characters<br>If the data set was deleted after being transferred, a number of question marks '????' are displayed instead of the name. |

#### 3.5.17.11.15 StartSave

| | | |
|---|---|---|
| Function | | Loads data sets to the PC. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Transfers a single data set to the PC |
| | 2 | Transfers all data sets of a recipe to the PC |
| | 3 | Transfers all data sets to the PC |

#### 3.5.17.11.16 SaveState

| | | |
|---|---|---|
| Function | | Displays the status of the data set transfer to the PC. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Transfers a single data set. |
| | 2 | Transfers all data sets of a recipe. |
| | 3 | Transfers all data sets in the operating device |

#### 3.5.17.11.17 StartRestore

| | | |
|---|---|---|
| Function | | Controls the transfer process from the PC to the operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |

| | | |
|---|---|---|
| Configurable values | 0 | Initial state |
| | 1 | Activate ready-to-receive |
| | 2 | Stop transfer |

#### 3.5.17.11.18 RestoreState

| | | |
|---|---|---|
| Function | | Displays the status of the data transfer to the operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Data transfer in progress |

#### 3.5.17.11.19 RestoreLineNr

| | | |
|---|---|---|
| Function | | Current line number in the data set file. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | 1 to 255 |

#### 3.5.17.11.20 StartRezPrint

| | | |
|---|---|---|
| Function | | Starts printing a data set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Start printing |
| | 2 | Stop printing |

#### 3.5.17.11.21 RezPrintState

| | | |
|---|---|---|
| Function | | Displays the status of the data set print process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Printing in progress |

#### 3.5.17.11.22 StartUpload

| | | |
|---|---|---|
| Function | | Loads the data set which is currently active in the controller to the operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Loads one variable at a time to the destination indicated in UploadDSNr. |
| | 2 | Loads variables as a block from the recipe buffer to the destination indicated in UploadDestNr. |
| | 3 | Loads one variable at a time and saves them automatically to a free data set. System message 18 is displayed if no free data set is available. |
| | 4 | Loads variable as a block from the recipe buffer and saves them automatically to a free data set. System message 18 is displayed if no free data set is available. |

#### 3.5.17.11.23 UploadDSNr

| | | |
|---|---|---|
| Function | | Number of the destination data set for the upload. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 1 to 250 | |

#### 3.5.17.11.24 UploadState

| | | |
|---|---|---|
| Function | | Displays the status of the data set upload. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Upload active |

## 3.5.17.12 Running Time Meters

#### 3.5.17.12.1 Counter1 to Counter8

| | | |
|---|---|---|
| Function | | Running time meter 1 to 8. The counter is incremented when the bit is set. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | 0 to 4.294.967.295 |

The function of the Running Time Meter is dependent on other parameters. See chapter “Running Time Meter“ on page 3-107.

## 3.5.17.13 Loop-Through Operation

#### 3.5.17.13.1 Pg2Sps

| | | |
|---|---|---|
| Function | | Enables/disables the loop-through mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Upload active |

Provisions must be made to be able to use the loop-through operation with the PG protocol !

#### 3.5.17.13.2 Pg2SpsState

| | | |
|---|---|---|
| Function | | Displays the status of the upload process of the loop-through mode. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Request loop-through mode |
| | 2 | Loop-through mode is possible |
| | 3 | Loop-through mode active |

## 3.5.17.14 Loadable Character Set

#### 3.5.17.14.1 ChrsetName

| | | |
|---|---|---|
| Function | | Displays the name of the current character set. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | Default (character set NORMAL or ZOOM used for display) |
| | | Character set name (user-created character sets used for display) |

## 3.5.17.15 Maintenance

#### 3.5.17.15.1 User1 to User5

| | | |
|---|---|---|
| Function | | For free use. |
| Data type | | Alphanumeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | Any, up to 16 bit |

The data is stored retentively in the operating device. The stored value is automatically used again after a power failure.

#### 3.5.17.15.2 LCDADCInput

| | | |
|---|---|---|
| Function | | Current input value of the AD converter for contrast control. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

#### 3.5.17.15.3 LCDDACOutput

| | | |
|---|---|---|
| Function | | Current input value of the DA converter for contrast control. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

#### 3.5.17.15.4 Break

| | | |
|---|---|---|
| Function | | Cancels the current input process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Cancel input process |

The input values are not transferred to the controller!

#### 3.5.17.15.5 StartCalibrationTouch

| | | |
|---|---|---|
| Function | | Starts the calibration process for the touch-screen. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Inactive |
| | 1 | Starts the calibration process |

Once you have set the system variable to the value 1, the next two touch screen touches are used for calibration! You must set up the system variable **StateCalibrationTouch** to ensure that operators will know how to proceed.

#### 3.5.17.15.6 StateCalibrationTouch

| | | |
|---|---|---|
| Function | | Displays the calibration status. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Touch to calibrate (the operator starts the calibration process with the next touch) |
| | 1 | Touch left pixel (the operator needs to touch a specific coordinate at the top left) |
| | 2 | Touch right pixel (the operator needs to touch a specific coordinate at the lower right) |
| | 3 | Calibration successful (calibration process complete) |

For the user interface, we recommend that you create a text list or an image list, and that you present the instructions to the operator as selection text or a selection image.

#### 3.5.17.15.7 MaskStartupTime

| | | |
|---|---|---|
| Function | | Displays how much time (in milliseconds) has elapsed for mask build-up. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | --- | Milliseconds |

#### 3.5.17.15.8 KeyResponseTime

| | | |
|---|---|---|
| Function | | Shows how much time (in milliseconds) elapses to modify a variable in the controller. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | --- | Milliseconds |

You can use this system variable only with touch panels.

## 3.5.17.16 Editors

#### 3.5.17.16.1 EditInvers

| | | |
|---|---|---|
| Function | | Displays the variable inverse while it is edited. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Not inverted |
| | 1 | Inverted |

#### 3.5.17.16.2 EditEnter

| | | |
|---|---|---|
| Function | | Controls the cursor when the Enter key is pressed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Cursor changes to the next input variable |
| | 1 | Cursor remains at the current position |

#### 3.5.17.16.3 StatePerm

| | | |
|---|---|---|
| Function | | Displays the status of the status-LED for the data release. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Status-LED OFF |
| | 1 | Status-LED ON |
| | 2 | Status-LED FLASHING |

## 3.5.17.17 Help

#### 3.5.17.17.1 StateHelp

| | | |
|---|---|---|
| Function | | Displays the status of the help status-LED. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Status-LED OFF |
| | 1 | Status-LED ON |
| | 2 | Status-LED FLASHING |

#### 3.5.17.17.2 Message

| | | |
|---|---|---|
| Function | | Displays the current system message. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 to 29 | Number of the system message |

To prevent a system message from being issued, you must delete the message text for the system message. This means, however, that the system message will not appear in any display forms.

#### 3.5.17.17.3 QuitMessage

| | | |
|---|---|---|
| Function | | Acknowledge the system message which is currently displayed. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Status-LED OFF |
| | 1 | Status-LED ON |
| | 2 | Status-LED FLASHING |

For operating devices equipped with a keyboard, this function is permanently linked with the Help key. There are a number of options for acknowledging a system message for touch-screen-operated operating devices.
See chapter “Buttons“ on page 3-99.

#### 3.5.17.17.4 StatusText

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.17.5 StatusText21

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 21st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.17.6 StatusText41

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 41st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

#### 3.5.17.17.7 StatusText61

| | | |
|---|---|---|
| Function | | Displays the most recent parallel message beginning from the 61st character. The message is displayed in accordance with the specified representation settings. |
| Data type | | Alphanumeric |
| Representation type | | Alphanumeric |
| Configurable values | | |

## 3.5.17.18 Print Logs

#### 3.5.17.18.1 SelectPrintLog

| | | |
|---|---|---|
| Function | | Number of the currently selected print log. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 255 | |

#### 3.5.17.18.2 StartPrintLog

| | | |
|---|---|---|
| Function | | Starts to print the currently selected print log. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Start printing |
| | 2 | Stop printing |

#### 3.5.17.18.3 StatePrintLog

| | | |
|---|---|---|
| Function | | Status of the current print process. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Ready |
| | 1 | Printing in progress |
| | 2 | Print process stopped by operator |
| | 3 | Error while printing |

#### 3.5.17.18.4 PageNumber

| | | |
|---|---|---|
| Function | | Current page of the current print job. Can be combined with the representation type "Bar" to create a progress indicator. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | | |

## 3.5.17.19 Compact Flash Card

TesiMod operating devices can only use Compact Flash cards formatted as FAT16. By default, the Windows XP® operating system formats Compact Flash cards in FAT32 format! Make sure to change the settings to activate the FAT16 format when formatting a Compact Flash card using Windows XP®!

#### 3.5.17.19.1 CardFileName

| | | |
|---|---|---|
| Function | | Name of a file which you want to access in write mode or read mode. Enter the file name including the file extension. The file name cannot exceed a length of 40 characters including the dot and the file extension! |
| Data type | | Alphanumeric |
| Representation type | | Selection Text |
| Configurable values | | |

You can display the content of the Compact Flash card using this system variable. The items for the text list are generated automatically.

#### 3.5.17.19.2 CardApplicationMove

| | | |
|---|---|---|
| Function | | Starts a firmware update from the Compact Flash card. The name of the S3 file must be entered in the system variable **CardFileName**. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Start firmware update |

#### 3.5.17.19.3 CardDataSetMove

| | | |
|---|---|---|
| Function | | Starts the transfer of data sets from the Compact Flash card to the operating device or vice versa. To be able to transfer data sets **from** the **Compact Flash** card to the operating device, the name of the data set must be entered in the system variable **CardFileName**. All of the data sets of the current recipe are transmitted during the transfer from the operating device to the Compact Flash card. The first 20 characters of the data set name are used as a file name. The file has the extension **.TXT**. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |

| | | |
|---|---|---|
| Configurable values | 0 | Initial state |
| | 1 | Transfer to the Compact Flash card |
| | 2 | Transfer to the operating device |

#### 3.5.17.19.4 CardFileDelete

| | | |
|---|---|---|
| Function | | Deletes the file specified in the system variable **CardFileName** from the Compact Flash card. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Deletes the file from the Compact Flash card. |

#### 3.5.17.19.5 CardFileError

| | | |
|---|---|---|
| Function | | Displays errors that occurred while using the Compact Flash card. The error number has different meanings depending on the type of operating device. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Possible Values for TesiMod operating devices | 0 | No error |
| | 1 | No Compact Flash card inserted. |
| | 2 | The specified file does not exist on the Compact Flash card or cannot be read. |
| | 3 | The Compact Flash card is full or write-protected. |
| | 4 | The file already exists on the Compact Flash card. |
| | 5 | The file has the wrong data type (.S3 for application and Firmware, .TXT for data sets) |
| | 6 | The S3 file was generated for another operating device. Select a different S3 file or generate a new S3 file for the corresponding operating device. |
| | 7 | The S3 file is for an operating device equipped with a different memory size. Select a different S3 file or generate a new S3 file for the corresponding operating device. |
| | 8 | The Compact Flash card was detected. |

| | | |
|---|---|---|
| Possible Values for Phoenix Contact CP-Devices | 0 | No error |
| | 1 | Wrong bank model |
| | 2 | Wrong device type |
| | 3 | Error opening file CPAPPL.SB from Compact Flash card. |
| | 4 | Error reading file CPAPPL.SB from Compact Flash card. |
| | 5 | Error closing file CPAPPL.SB from Compact Flash card. |
| | 6 | Checksum error |

#### 3.5.17.19.6 CFCardError

| | | |
|---|---|---|
| Function | | Displays errors that occurred while using the Compact Flash card. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | No error |
| | 1 | No Compact Flash card in device. |
| | 2 | The requested file does not exist on the Compact Flash card. |
| | 3 | The Compact Flash card is full or write-protected. |
| | 4 | The file already exists on the Compact Flash card. |
| | 5 | File has the wrong file extension. |
| | 6 | S3 file is for the wrong device type. |
| | 7 | S3 file is for the wrong memory type. |
| | 8 | The Compact Flash card was detected. |

## 3.5.17.20 Set of Curves (Graph)

#### 3.5.17.20.1 DataLogTrig

| | | |
|---|---|---|
| Function | | Release a trigger event for a data logger. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Trigger for data logger 1 |
| | 2 | Trigger for data logger 2 |
| | 3 | Trigger for data logger 3 |
| | 4 | Trigger for data logger 4 |

#### 3.5.17.20.2 DataLogClear

| | | |
|---|---|---|
| Function | | Erase the memory of a data logger |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 | Initial state |
| | 1 | Erase the memory of data logger 1 |
| | 2 | Erase the memory of data logger 2 |
| | 3 | Erase the memory of data logger 3 |
| | 4 | Erase the memory of data logger 4 |

### 3.5.17.21 Sound

#### 3.5.17.21.1 Volume

| | | |
|---|---|---|
| Function | | Volume of the loudspeaker. Only for Dornier MedTech. devices. |
| Data type | | Numeric |
| Representation type | | Positive decimal number, alphanumeric, selection text, selection image, hexadecimal number, binary number |
| Configurable values | 0 to 15 | 0 = low15 = high |

## 3.6 Dynamic Attributes

For the mask elements Static Text, Text Field, and Variable, you can assign 255 ranges of values for dynamic attributes.

Dynamic attributes change the display of a text or variable value in the operating device, based on a variable or control variable value.

You can display up to 25 objects with dynamic attributes in a mask.

The system displays the values for the upper and lower limit in a list box. In the same line, it displays the attributes for values that are within the limits. You cannot enter overlapping value ranges!

1. Enter the values for the upper and lower limit under the list box.
2. Select the corresponding attributes in the relevant check boxes.
3. Assign the attributes to the range of values. The range of values and its attributes are simultaneously entered in the list box.

The dynamic attributes are either derived directly from the value of a variable or from the value of a corresponding control variable.

For variables in input and output masks, the entry of a control variable is optional.

In general, no control variables are permitted in recipes. Here, the dynamic attributes can only be derived from the value of the variables.

For texts in input/output masks, a control variable is always required to control the attributes.

You cannot assign dynamic attributes for texts in recipes.

To assign dynamic attributes, carry out the following steps:

1. Click one of the lines in the list box.
2. Enter limit values into the appropriate fields.
3. Select the corresponding attributes.
4. Enter the name of the control variable, if needed.
5. Click the Assign button.

You can assign the following attributes:

– Underline
– Inverse
– Flashing
– Invisible
– Non-editable
– Foreground
– Background

## 3.6.1 Underline

You can assign the (dynamic) attribute **Underline** to variables and static texts.

Figure 3-15 Text with the Underline attribute

## 3.6.2 Inverse

You can assign the (dynamic) attribute **I**nverse to variables and static texts. This format is particularly suitable if you want to emphasize the variable that is currently selected.

Figure 3-16 Text with the Inverse attribute

## 3.6.3 Flashing

You can assign the (dynamic) attribute **Flashing** to variables and static texts. Note that an element that is assigned this attribute is displayed in the strikethrough format and not as flashing text.

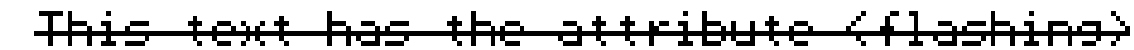


Figure 3-17 Text with the Flashing attribute

### 3.6.4 Invisible

You can assign the dynamic attribute **Invisible** to variables and static text, to ensure that they do not appear below or above specific controller values.

### 3.6.5 Non-Editable

You can assign the dynamic attribute **Non-Editable** to variables, to ensure that they cannot be changed below or above specific controller values.

### 3.6.6 Foreground

You can assign the (dynamic) attribute 'Foreground' to variables and static text, to ensure that they are (when values are below or above specific controller values) are displayed with a specific color.

### 3.6.7 Background

You can assign the (dynamic) attribute 'Foreground' to variables and static text, to ensure that they are (when values are below or above specific controller values) are displayed in front of a specific background.

### 3.6.8 Attribute Priorities

1. First, the attributes of the variable or text set in the normal dialog box for the mask element are used.
2. If a control variable exists, its value and the range of values definition are used to define the dynamic attribute.
3. If no control variable exists, the value of the PLC variables and the range of values definition are used to determine the dynamic attribute. (Not in the case of static texts).
4. If value-specific attributes were defined in the text list for selection texts, these attributes are used.

## 3.7 Set of Curves (Graph)

You use sets of curves to graphically display the values that are recorded by one or more data loggers.

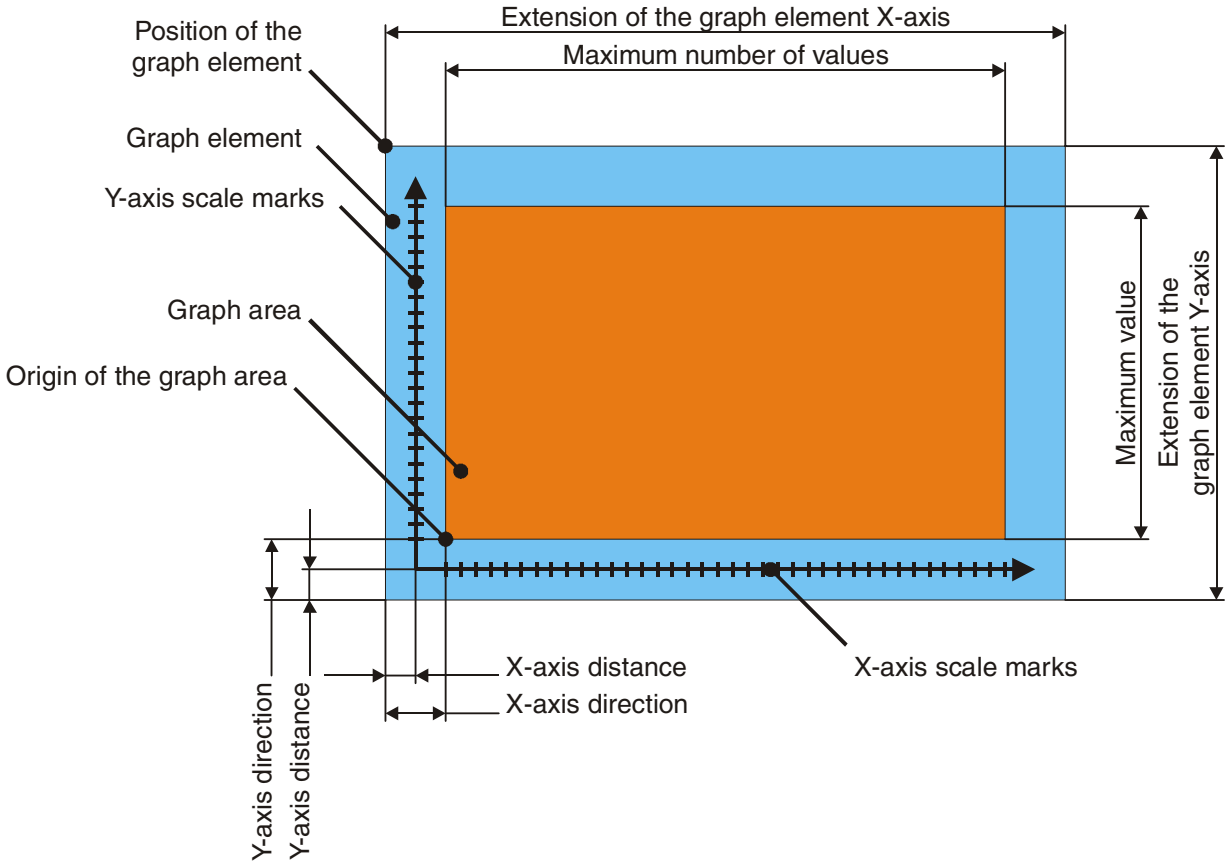



Figure 3-18 Structure of a set of curves

### 3.7.1 Data Logger

You can program four independent data loggers.

The data loggers record cyclical or event-driven values between 0 and 254 from the controller. These values are displayed graphically in a set of curves.

For each data logger, you assign a name and a byte address in the controller.

You can specify a recording type for each data logger:

– Plotter continuous (single values): The plotter moves over the output area and, in doing so, outputs the values (like an oscilloscope).
– Plotter static (single values): The curve is drawn continuously from the left or right edge (like an ECG plotter).
– Flash light (all values): The values for the curve are read as a snapshot from the controller and displayed in full (copy of all data at a point in time)

The number of data points must be specified for the horizontal direction.

You can also select the display orientation.

## 3.8 Images

You can use images as:

- Background images in masks
- Content for image lists that represent variable values
- Icons for internal error messages
- Images for buttons
- A frame for buttons

You can import images or embed them as objects.

All images that you create are available in the programming software at the location where you can work with images.

Double-click an embedded object to open the application program that you used to create the object. You can now edit the object directly. The system enters the changes to the object into the programming software after you close the application.

## 3.9 Symbols

Symbols are images with two colors that are displayed on touch screen operating devices.

The advantage of using symbols is that you can customize the foreground and background color. If symbols are used in buttons, the colors of the icon are determined depending on the color settings of the button (for example, you can program a button to change color when it is pressed).

It is also easy to reuse symbols as the color is determined by the button or the background.

## 3.10 Buttons

Buttons are graphic areas that are linked with a specific function. When you press a button, the preconfigured function is activated. This only applies to operating devices equipped with a touch screen. On operating devices with a full graphics display, buttons can only be used to display images, variables or texts.

For operating devices with a display larger than 10.4"", the buttons you create must be no smaller than 45 x 45 pixels. Otherwise it cannot be guaranteed that the system will correctly recognize a button when you select it!

Do not use pens for touch-screen operating devices with a display larger than 10.4""! PDA pens cannot be reliably used to operate these devices.

A button can be broken down into the following:

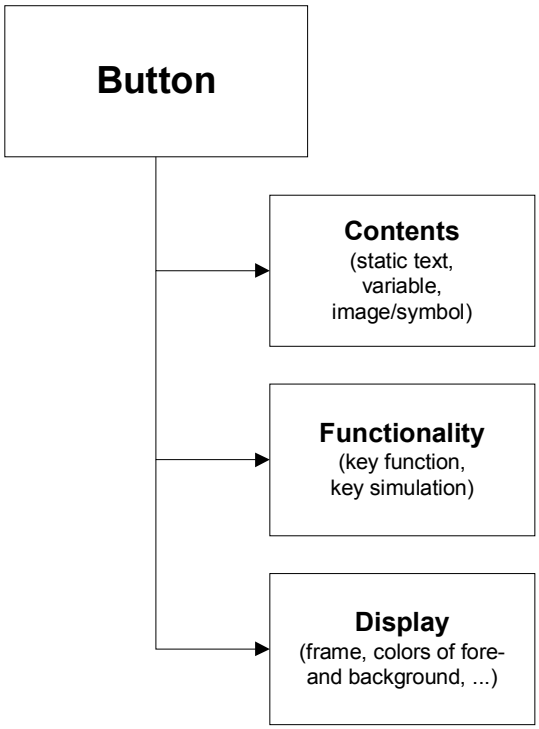



Figure 3-19 Button

The button content, the functions and the representation (display frame, other attributes) can, for the most part, be programmed independently of each other.

### 3.10.1 Content of Buttons

A button can contain a static text, a text field, a mask variable, an image/ symbols or nothing at all.

Buttons that have no content are displayed without a frame and are transparent mask elements. (Application: Transparent buttons are superimposed on a background image, for example, a plant overview to map “hot areas“ on an image. When you select this area, a specific action is carried out, for

example, the system opens another mask).

## 3.10.2 Functions of Buttons

A button can trigger the following functions:

- Open another mask
- Write a value (byte) to a PLC or system variable when you press the button
- Write a value (byte) to a PLC or system variable when you release the button
- Simulate any key
- Generate a free tone
- Activate or open the Editor for an input variable
- No action

## 3.10.3 Representation of Buttons

Attributes for displaying a button are:

- Foreground and background color for the pressed and released states
- Position and dimension of the button
- Frame for the pressed and released states

Note:

- When you program an input variable in the same way as for a keyboard-operated operating device, a button is automatically generated around the variable.
- Buttons can only overlap with background images.
- Buttons in tables that contain a variable have no frame and have one line.
- Buttons in input and output masks are not allowed to contain any input variables.
- When you program a button with an input variable of the type Selection Text or Selection Image, the **Enter** button is automatically created (on request). In other words, no input or output mask is linked for both of these types. The user presses the button to navigate in the corresponding list. If the selection text variable only has one line, the variable value is decremented when you press the left half of the button, and incremented when you select the right half. For multi-line selection text variables and for selection image variables in general, the variable value is decremented when you press the top half of the button, and incremented when you press the bottom half.

The following image depicts a button that has a horizontal layout.

This type is activated for selection text that only has one line.

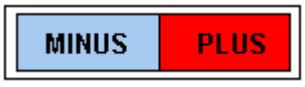



Figure 3-20 Button with horizontal layout

The following image depicts a button that has a vertical layout.

This type is activated for selection texts and selection images with several lines.

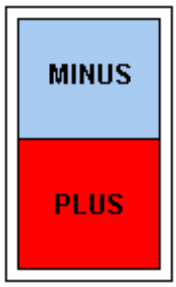



Figure 3-21 Button with vertical layout

### 3.10.3.1 Frames for Buttons

The frame for a button is created as an image that is saved in the programming software as an image. This image is then made available by the programming software, and you can use it for button frames.

In the following example, a frame is created that depicts a button when it is not pressed (released state).

The image for this frame looks like this:

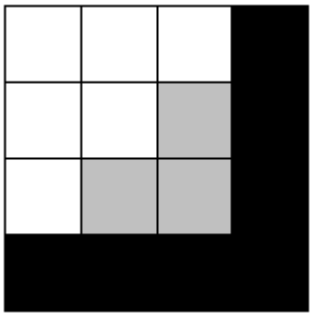


Figure 3-22 Image for a basic frame

This image is made up of four subareas.

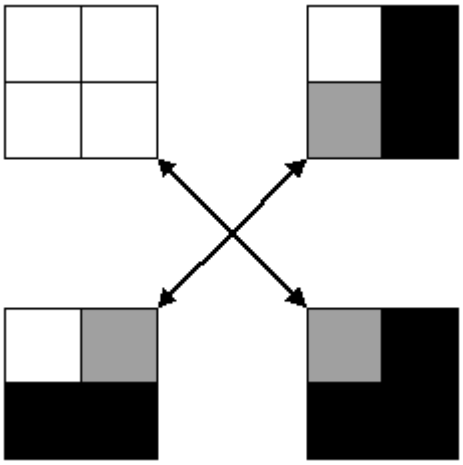


Figure 3-23 Image split into four areas

The programming software automatically splits an image into these four areas.

The pixels for the edges are then determined and inserted a number of times, depending on the dimension of the button.

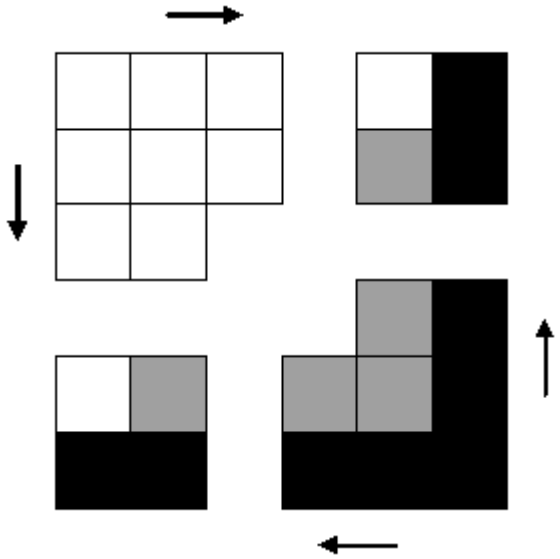


Figure 3-24 Determining and expanding frame edges

In this context, only the top left and bottom right corners are taken into account. For the following image, each frame edge has been expanded by two pixels.

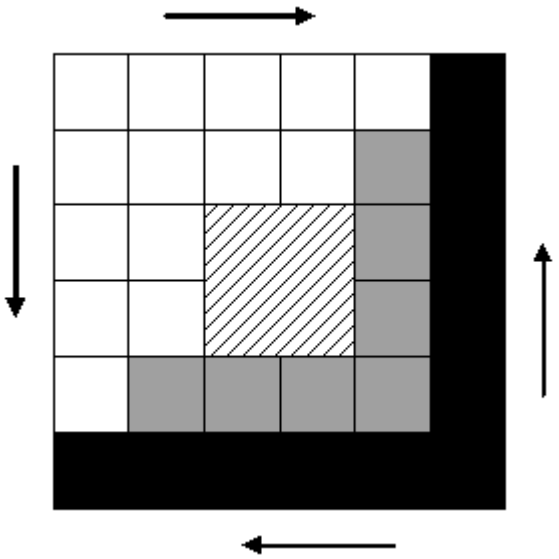


Figure 3-25 Button: Final result

The arrows in the image illustrate the directions in which the pixels are inserted for the frame edges.

The hatched area depicts the button's usable area. Texts, variables, and images are displayed here. You can assign a background color to this area.

You can use the formats bit map (BMP), device-independent bit map (DIB), Windows Metafile (WMF) or Enhanced Metafile (EMF) to create images.

## 3.11 Function Keys/Softkeys

Another important feature, in addition to the masks, are the function keys and their LEDs. Function keys are user-programmable. They can be used as direct selector keys to switch to another mask or as control keys for the machine. When used as control keys, the integrated LEDs provide feedback information.

Programming the function keys as direct selector keys allows fast, direct access to the masks as well as to entire menu structures.

If the operating device is fitted with parallel outputs, any eight function keys can be assigned to the outputs directly. The reaction time after pressing a key is approximately 30 ms. Before a function key signal is provided, the terminal debounces the key, thereby ensuring that it has actually been 'pressed'.

In the programming system, the combination of direct selection and control function can be programmed for function keys and for soft keys. Only the press codes of the keys should be evaluated in this mode of operation. This is because, depending on the length of time the key is pressed and the nature of the assigned mask, the stop code may have already changed!

### 3.11.1 Direct Selector Keys

Direct selector keys are function keys programmed to directly call up a specific mask. Pressing this function key thereby allows you to directly change to another mask.

This change of mask is not possible if the data release has been requested (status LED in the Data Release key is flashing or lights up) in a mask without automatic data release.

Direct selector keys allow speedy and convenient operation.

### 3.11.2 Function Keys in the Controller

In addition to programming function keys as direct selector keys, they can be programmed to carry out a function in the controller. To do this, instead of assigning a mask change to a function key, assign it the symbolic name of a controller variable in the application description.

When you press the key, it can set or reset the variable, and the same functions are assigned to it when you release the key. If you assign the set function to the key, the value entered is assigned to the data type.

In other words:

If the digit 1 is entered as the value:

– A flag bit receives logical 1
– A flag byte receives the value 01h
– A flag word receives the value 0001h
– A double word receives the value 00000001h

For values greater than 1, you must specify at least a byte address for the variable.

### 3.11.3 Softkeys

Soft keys are function keys that carry out a different function, depending on the mask in which the appear. The current function of a soft key is described in the current mask. In this context, you can use images, background images, selection images, static texts, and selection texts.

If you use a selection text to label soft keys, you can use the function key for several functions within a mask.

The action to be performed is determined by the:

– Mask number
– Number of the selection text
– Variable value transferred with the softkey.

Depending on the operating device, the number of keys you can use as soft keys varies.

**Example:** We want a softkey (F1) in mask 10 to be able to switch a pump on and off.

1. Create a text list (pump) with two entries.

Table 3-19 Text list for example softkey.

| Value | Text |
|---|---|
| 0 | Switch Pump OFF |
| 1 | Switch Pump ON |

2. Define the variables.

Table 3-20 Variables for example softkey.

| Symbolic Name | Address (Example) |
|---|---|
| Soft Key Labeling | M100.0 |
| Softkey Status | M100.1 |
| Mask Image | MW110 |

3. Create the mask (number 10).

Set up a controller variable (M 100.0) next to or above a function key.

Link the controller variable with the representation type Selection Text for cyclical output with the text list (pump).

Link the function key F1 of the mask with the variable Soft Key Status (M 100.1), (set/reset).

4. Create the controller program to perform the following: Output A32.0 is to be used to control the pump.

Evaluate the mask number (MW 110); (must have the value 10).

Evaluate the edge for M 100.1.

Create a ELTACO function for pump output A32.0.

Use it to set flag M 100.0 to 0 when the pump is on.

Use it to set flag M 100.0 to 1 when the pump is off

## 3.11.4 Reaction Time of Function and Soft Keys

Whenever function keys need to influence PLC variables, they are given highest priority when transferred via the protocol. The reaction times during the transfer procedure are protocol-specific and range from 60 to 120 ms. This is the period of time which elapses after a key has been pressed until an output is set or reset in the PLC. The reaction time varies depending on the protocol itself, the load on the protocol (cyclical data, etc.) and the cycle time of the PLC.

Note that reaction times can be influenced by the polling times of the variables, messages and images of the LEDs.

## 3.11.5 Using Control Keys as Function Keys

Control keys can alternatively be used as function keys to trigger certain actions in the PLC. They can be defined to carry out the same functions as function keys, i.e. they are capable of assigning any values to a variable. The transfer procedure is independent of the mask parameter assignment. Thus, if a control key is to carry out a specific function in a mask, it should not be programmed as a 'mask selector key' at the same time. The mask-specific evaluation is identical to that of the function key.

## 3.11.6 Function Keys Controlling Parallel Outputs

Groups of eight function keys can be linked to parallel outputs (semiconductor outputs). The keys are read in by the software, debounced and then mapped to the outputs. The reaction time to the outputs is around 30 ms. The parallel output option offers users the advantage that the keys act on the PLC very quickly and independently of the protocol. They are ideal for controlling axes or for programming jogging mode!

The power output allows direct control of PLC inputs.

If a PLC variable has been programmed for the function key in addition to the output, it is of course also sent to the controller, though with a small time delay.

## 3.11.7 Status LEDs of Function Keys

For each function key status LED, a 2-bit piece of information is available in the cyclical polling area. One bit activates or deactivates the corresponding status LED, the other bit displays the flashing attribute of the status LED. The status LEDs can only be influenced by the controller.

See chapter "Image of the Status LEDs" on page 3-117.

The following exceptions apply:

- You have programmed a function key as a direct selector key for a message mask
- You have entered a value greater than 0 (zero) as the message priority.

In these cases, the status LED of this function key cannot be influenced by the controller! In these situations, the status LED can only be controlled using the message functions.

If the operating device you are using has less status LEDs than can be controlled here, the superfluous bits have no function.

To minimize the transfer times, select the length of the polling area so that only the bytes required for status LEDs are transferred.

## 3.12 Running Time Meter

Each operating device has 8 running time meters.

**Control Byte**

Each running time meter is assigned a bit in the control byte. Using the control byte, the controller can influence the running time meters in the operating device.

If bit X is set in the control byte when polling is carried out, the running time meter X is incremented. In each case, the value of the running time meter is stored in the system variable CounterX.

Table 3-21 Control byte of the running time meter

| Bit | Counter | System Variable |
|---|---|---|
| 0 | 1 | Counter1 |
| 1 | 2 | Counter2 |
| 2 | 3 | Counter3 |
| 3 | 4 | Counter4 |
| 4 | 5 | Counter5 |
| 5 | 6 | Counter6 |
| 6 | 7 | Counter7 |
| 7 | 8 | Counter8 |

**Reset Byte**

Each running time meter is assigned a bit in the reset byte. Using the reset byte, the controller can reset the running time meters in the operating device.

If bit X is set in the reset byte when polling is carried out, the running time meter X is reset to 0.

Table 3-22 Reset byte of the running time meter

| Bit | Counter | System Variable |
|---|---|---|
| 0 | 1 | Counter1 |
| 1 | 2 | Counter2 |
| 2 | 3 | Counter3 |
| 3 | 4 | Counter4 |
| 4 | 5 | Counter5 |
| 5 | 6 | Counter6 |
| 6 | 7 | Counter7 |
| 7 | 8 | Counter8 |

**Polling Time**

You use the polling time to specify the time intervals at which the operating device reads from the controller the variables for the control byte and the reset byte.

The running time meters are activated in the operating device as soon as you have entered a variable name for the control byte and specified a value for the polling time. If the polling time is 0 or if there is no address for the control byte, the Running Time Meter function in the operating device is off.

**Transferring counter value**

For each running time meter, you can enter a variable name in the controller. The operating device stores the value of the corresponding running time meter if the controller requests that the operating device to do so.

For this purpose, the controller writes the hexadecimal code **7FCF** into the serial message channel of the polling area.

For each variable, a 32-bit memory area must be available in the controller!

**For example:**

You want to set up a running time meter for a maintenance interval of 50 hours. The polling time for the counter = 60 seconds (the counter increases by one each minute).

| | | |
|---|---|---|
| System Variable | Counter1 | |
| Representation Type | Decimal Number | |
| Format | Field length | 4 |
| | Fractional digits | 1 |
| | Only positive | |
| Scaling | Factor | 1 |
| | Divisor | 6 |
| | Addend | 0 |

After 150 polling cycles, the operating device displays a value of 2.5 hours.150 / 6 + 0 = 25Using the format 'Fractional Digits=1', the value 25 is displayed as 2.5!This example has a precision of +/- 6 minutes.

## 3.13 Read Coordination Byte

The Read Coordination byte is used for handshake and data coordination with the controller.

If necessary, the controller reads the Read Coordination byte and evaluates the individual bits.

Table 3-23 Structure of the Read coordination byte

| Bit | Abbreviation | Function |
|---|---|---|
| 0 | EA | Editing Request |
| 1 | EZ | Editing Status |
| 2 | RA | Refresh Request |
| 3 | LM | Liveness Flag |
| 4 | DDA | Data Set Download Active |

Table 3-23 Structure of the Read coordination byte

| Bit | Abbreviation | Function |
|---|---|---|
| 5 | | Not used |
| 6 | | |
| 7 | | |

The Read Coordination byte only works together with the Write Coordination byte.

## 3.13.1 Editing Request

The operating device uses the Editing Request bit to indicate to the controller that the value of a variable will be changed.

For this purpose, the operating device writes a logical 1 to the **Editing Request** bit in the Read Coordination byte.

To allocate an editing release to the operating device, the controller writes a logical 1 to the Editing Release bit in the Write Coordination byte.

## 3.13.2 Editing Status

The operating device uses the Editing Status bit to indicate to the controller that the value of a variable could be changed.

Once the operating device has received the Editing Release from the controller, the device sets the **Editing Status** bit in the Read Coordination byte to logical 1.

The operator can now change the variable value. To send the changed variable value to the controller, the operator must select the **Enter** key to complete the entry**.**

The operator can then change other variable values.

Then, the operator must press the **Data Release** key. This resets the **Editing Status** bit to logical 0.

The **Refresh Request** and **Refresh Acknowledgment** bits are used to write the new variable value to the controller.

Once the controller has read the new variable value, it uses the **Refresh Acknowledgment** bit to indicate of the Write Coordination byte that the **Editing Status** bit can once again be reset to logical 0.

## 3.13.3 Refresh Request

If you changed a variable value in the operating device, and selected the Data Release key, the **Refresh Request**bit in the Read coordination byte

must be set to logical 1.

This triggers the read process in the controller, and then confirms it with the **Refresh Acknowledgment** bit in the Write Coordination byte.

### 3.13.4 Liveness Flag

In some communication protocols, you cannot control the operability of the interface in the controller. The **Liveness flag** has been developed to address this shortfall. This is a simple function, which has proven very effective in practice.

Whenever the controller needs to know whether the connection is still active, it writes a logical 1, and subsequently a logical 0, to bit 3 of the Write Coordination byte.

The operating device constantly monitors the Liveness flag in the Write Coordination byte and compares it with the status of the Liveness flag in the Read Coordination byte. As soon as the two bytes are no longer the same, the operating device copies bit 3 from the Write Coordination byte to the Read Coordination byte.

Within a timeout time, the controller must now also check whether both statuses are identical.

When you determine the timeout time, remember to take the transfer times and polling times into account.

### 3.13.5 Data Set Download Active

As soon as the operating device transfers a data set to the controller, it writes a logical 1 to the Data Set Download Active bit. After all data were sent, the operating device writes a logical 0 to the Data Set Download Active bit. The controller can now work with the new data set values.

## 3.14 Write Coordination Byte

The term Write Coordination byte indicates that the controller writes this byte.

The Write Coordination byte is only read by the operating device. This byte is used together with the Read Coordination byte for the handshake and data coordination with the controller.

Here, the controller indicates its current status to the operating device. The

individual bits are independent of each other.

Table 3-24 Structure of the Write coordination byte

| Bit | Abbreviation | Function |
|---|---|---|
| 0 | ED | External Data Release |
| 1 | RQ | Refresh Acknowledgment |
| 2 | PL | Delete Password |
| 3 | LM | Liveness Flag |
| 4 | DDF | Data Set Download Release |
| 5 | | Free |
| 6 | | |
| 7 | | |

The Write Coordination byte only works together with the Read Coordination byte.

### 3.14.1 External Data Release

The controller can use the External Data Release bit to influence data release in the operating device. If the operator would like to change a value in the operating device, he must first request data release. For this purpose, the operating device writes a logical 1 to the Editing Request bit in the Read Coordination byte. During this time, the Data Release status LED flashes.

Once the controller establishes that the Editing Request bit in the Read Coordination byte is set to logical 1, it can release the editing process in the operating device by setting the External Data Release bit in the Write Coordination byte to logical 1. The Data Release status LED is then lit.

### 3.14.2 Refresh Acknowledgment

Once the controller has read the Refresh Request bit in the Read Coordination byte as logical 1, it can read in the changed variable value. When finished, the controller can write a logical 1 to the Refresh Acknowledgment bit, and confirm execution to the operating device.

### 3.14.3 Delete Password

When the operator exits a mask for which he requires a password for access, password protection needs to be activated again for this mask. This can be forced by the controller by entering a logical 1 in the Delete Password bit.

### 3.14.4 Liveness Flag

In some communication protocols, you cannot control the operability of the interface in the controller. The **Liveness flag** has been developed to address this shortfall. This is a simple function, which has proven very effective in practice.

Whenever the controller needs to know whether the connection is still active, it writes a logical 1, and subsequently a logical 0, to bit 3 of the Write Coordination byte.

The operating device constantly monitors the Liveness flag in the Write Coordination byte and compares it with the status of the Liveness flag in the Read Coordination byte. As soon as the two bytes are no longer the same, the operating device copies bit 3 from the Write Coordination byte to the Read Coordination byte.

Within a timeout time, the controller must now also check whether both statuses are identical.

When you determine the timeout time, remember to take the transfer times and polling times into account.

### 3.14.5 Data Set Download Release

The controller determines the start time of a data set transfer from the operating device to the controller by writing a logical 1 in the Data Set Download Release bit.

## 3.15 The Cyclical Polling Area

The cyclical polling area is a freely definable memory area in the controller.

The controller writes to this memory area.

The operating device polls this memory area cyclically. In other words, it reads the content in regular intervals.

The polling area is created in a byte-oriented or word-oriented manner.

The controller must be able to access this memory area bit-by-bit, and the memory area must be continuous.

The operating device accesses this memory area byte-by-byte or word-by-word.

The polling area is broken down into three zones:

1. Write Coordination byte (1 byte)
2. Serial message channel (2 bytes – high byte and low byte)
3. Control bytes for the status LEDs of the function keys (number depends on the operating device type)

You must enter the starting address for the polling area in the system parameters for the polling area.

Here, enter the length of the polling area and the polling time as well.

The length of the polling area is based on the number of status LEDs on the operating device that is being used.

The polling time is based on the total system load. Note the cycle times for other variables!

The structures of byte- and word-oriented polling areas are a little different. Therefore, a selection cannot be changed once made.

### 3.15.1 Byte-Oriented Polling Area

The byte-oriented polling area is located on a byte address. The controller must be able to access this area in bit-mode!

Table 3-25 Byte-oriented polling area

| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| Byte Address +0 | Write Coordination Byte | | | | | | | |
| | Free | Free | Free | DDF | LM | PL | RQ | ED |
| Byte Address +1 | Serial Message Channel Low Byte | | | | | | | |
| Byte Address +2 | Serial Message Channel High Byte | | | | | | | |
| Byte Address +3 | LED1 On/Off | LED1 Flashing | LED2 On/Off | LED2 Flashing | LED3 On/Off | LED3 Flashing | LED4 On/Off | LED4 Flashing |
| Byte Address +4 | LED5 On/Off | LED5 Flashing | LED6 On/Off | LED6 Flashing | LED7 On/Off | LED7 Flashing | LED8 On/Off | LED8 Flashing |
| Byte Address +5 | LED9 On/Off | LED9 Flashing | LED10 On/Off | LED10 Flashing | LED11 On/Off | LED11 Flashing | LED12 On/Off | LED12 Flashing |
| Byte Address +6 | LED13 On/Off | LED13 Flashing | LED14 On/Off | LED14 Flashing | LED15 On/Off | LED15 Flashing | LED16 On/Off | LED16 Flashing |
| Byte Address +7 | LED17 On/Off | LED17 Flashing | LED18 On/Off | LED18 Flashing | LED19 On/Off | LED19 Flashing | LED20 On/Off | LED20 Flashing |
| Byte Address +8 | LED21 On/Off | LED21 Flashing | LED22 On/Off | LED22 Flashing | LED23 On/Off | LED23 Flashing | LED24 On/Off | LED24 Flashing |
| Byte Address +9 | LED25 On/Off | LED25 Flashing | LED26 On/Off | LED26 Flashing | LED27 On/Off | LED27 Flashing | LED28 On/Off | LED28 Flashing |
| Byte Address +10 | LED29 On/Off | LED29 Flashing | LED30 On/Off | LED30 Flashing | LED31 On/Off | LED31 Flashing | LED32 On/Off | LED32 Flashing |
| Byte Address +11 | LED33 On/Off | LED33 Flashing | LED34 On/Off | LED34 Flashing | LED35 On/Off | LED35 Flashing | LED36 On/Off | LED36 Flashing |

Table 3-25 Byte-oriented polling area

| | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|
| Byte Address +12 | LED37 On/Off | LED37 Flashing | LED38 On/Off | LED38 Flashing | LED39 On/Off | LED39 Flashing | LED40 On/Off | LED40 Flashing |
| Byte Address +13 | LED41 On/Off | LED41 Flashing | LED42 On/Off | LED42 Flashing | LED43 On/Off | LED43 Flashing | LED44 On/Off | LED44 Flashing |
| Byte Address +14 | LED45 On/Off | LED45 Flashing | LED46 On/Off | LED46 Flashing | LED47 On/Off | LED47 Flashing | LED48 On/Off | LED48 Flashing |

## 3.15.2 Word-Oriented Polling Area

The word-oriented polling area is located on a word address. The controller must be able to access this area in bit-mode!

Table 3-26 Word-oriented polling area

| | Bit 15 | Bit 14 | Bit 13 | Bit 12 | Bit 11 | Bit 10 | Bit 9 | Bit 8 | Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Word Address +0 | Write Coordination Byte | | | | | | | | | | | | | | | |
| | Free | Free | Free | DDF | LM | PL | RQ | ED | Free | Free | Free | Free | Free | Free | Free | Free |
| Word Address +1 | Serial Message Channel High Byte | | | | | | | | Serial Message Channel Low Byte | | | | | | | |
| Word Address +2 | LED1 On/Off | LED1 Flashing | LED2 On/Off | LED2 Flashing | LED3 On/Off | LED3 Flashing | LED4 On/Off | LED4 Flashing | LED5 On/Off | LED5 Flashing | LED6 On/Off | LED6 Flashing | LED7 On/Off | LED7 Flashing | LED8 On/Off | LED8 Flashing |
| Word Address +3 | LED9 On/Off | LED9 Flashing | LED10 On/Off | LED10 Flashing | LED11 On/Off | LED11 Flashing | LED12 On/Off | LED12 Flashing | LED13 On/Off | LED13 Flashing | LED14 On/Off | LED14 Flashing | LED15 On/Off | LED15 Flashing | LED16 On/Off | LED16 Flashing |
| Word Address +4 | LED17 On/Off | LED17 Flashing | LED18 On/Off | LED18 Flashing | LED19 On/Off | LED19 Flashing | LED20 On/Off | LED20 Flashing | LED21 On/Off | LED21 Flashing | LED22 On/Off | LED22 Flashing | LED23 On/Off | LED23 Flashing | LED24 On/Off | LED24 Flashing |
| Word Address +5 | LED25 On/Off | LED25 Flashing | LED26 On/Off | LED26 Flashing | LED27 On/Off | LED27 Flashing | LED28 On/Off | LED28 Flashing | LED29 On/Off | LED29 Flashing | LED30 On/Off | LED30 Flashing | LED31 On/Off | LED31 Flashing | LED32 On/Off | LED32 Flashing |
| Word Address +6 | LED33 On/Off | LED33 Flashing | LED34 On/Off | LED34 Flashing | LED35 On/Off | LED35 Flashing | LED36 On/Off | LED36 Flashing | LED37 On/Off | LED37 Flashing | LED38 On/Off | LED38 Flashing | LED39 On/Off | LED39 Flashing | LED40 On/Off | LED40 Flashing |
| Word Address +7 | LED41 On/Off | LED41 Flashing | LED42 On/Off | LED42 Flashing | LED43 On/Off | LED43 Flashing | LED44 On/Off | LED44 Flashing | LED45 On/Off | LED45 Flashing | LED46 On/Off | LED46 Flashing | LED47 On/Off | LED47 Flashing | LED48 On/Off | LED48 Flashing |

## 3.15.3 Serial Message Channel

The serial message channel is a part of the cyclical polling area and is used to transfer 16-bit information. The numbers of serial messages, selection of message masks, external selection of masks and transfer of control codes are made possible via this data channel.

The following handshake is used for the information transfer:

The PLC stores a value (> 0) in this data word. This value is then transferred to the operating device which will write the value 0 into this data word again. This indicates to the PLC that it can now transfer the next value. The value is interpreted by the operating terminal and its function is executed.

Values can be:

– Message numbers
– Mask numbers (mask number + 8000H)
– Control Codes

## 3.15.4 Image of the Status LEDs

The LED image enables the controller to control the status LEDs of the function keys of the connected operating device. The functions ON, OFF, or FLASHING can be set for each status LED. As soon as the controller sets a bit, the assigned LED on the operating device is influenced accordingly.

In this context, it is important that the length of the polling area and the polling time were also set correctly. If these additional parameters were not set correctly, problems may occur during the LED control.

For a function key that leads directly to the message mask, the status LED is influenced by the message system. In this way, the message system indicates that a new message has been received and has not yet been acknowledged. To influence the status LED of this function key from the controller, you must set the message priority to 0 (zero).

Table 3-27 Truth table for a status LED

| Bit 1 | Bit 2 | Status of the LED |
|---|---|---|
| 0 | 0 | OFF |
| 0 | 1 | OFF, FLASHING is preset |
| 1 | 0 | ON |
| 1 | 1 | FLASHING |

## 3.15.5 Polling Time

The polling time specifies the intervals the operating device will use to read the variable for the cyclical polling area. You set the polling time in the system parameters for the polling area. The polling of this variable also covers the Write Coordination byte, the serial message channel, and the image of the status LEDs.

Settings in or around a half a second have proven useful in most protocols. If the cycle time set is too low, the interface protocol can no longer follow requests, and reaction performance deteriorates.

There is no universal recipe, however.

The options available primarily depend on the individual project. However, at

the very least, times greater than 100 ms should be preselected. For further information, please contact our support hotline.

### 3.15.6 Size of the Polling Area

Depending on the data type and operating device, the polling area has a length of up to 23 bytes. The entry allows adjustment to suit the area actually used, if you can avoid using the image of the status LED or part of this. The basic setting for all operating devices is a length of 12 bytes.

## 3.16 Control Codes

You can use hexadecimal control codes to control special functions on the operating device. The control codes are transferred to the operating device using the polling area. The operating device interprets the control code and subsequently triggers the corresponding function.

The following functions can be requested by the controller:

Table 3-28 Control Codes

| Code | Function |
|---|---|
| 7FC7 | Delete data logger 1 |
| 7FC8 | Delete data logger 2 |
| 7FC9 | Delete data logger 3 |
| 7FCA | Delete data logger 4 |
| 7FCB | Trigger data logger 1 |
| 7FCC | Trigger data logger 2 |
| 7FCD | Trigger data logger 3 |
| 7FCE | Trigger data logger 4 |
| 7FCF | Write values of the running time meters to the controller |
| 7FEx | Switch to another language (x = language number) |
| 7FF2 | Automatic data release for scanner module |
| 7FF3 | Reload event-controlled variable values |
| 7FF4 | Transfer single data set from the controller |
| 7FF5 | Delete acknowledged messages from serial message memory |
| 7FF6 | Cancel printing the print log |
| 7FF7 | Printing a print log |
| 7FF8 | Printing a data set |
| 7FF9 | Set clock in operating device |
| 7FFA | Data set transfer from controller to operating device (block mode) |

Table 3-28 Control Codes

| Code | Function |
|---|---|
| 7FFB | Data set transfer from operating device to controller |
| 7FFC | Send keyboard image to controller |
| 7FFD | Data set transfer from controller to operating device (single mode) |
| 7FFE | Erase serial message memory |
| 7FFF | Refresh message system |

### 3.16.1 Delete Data Logger

You can use the following control codes from the controller, to have the operating device delete the data logger values.

**Hexadecimal code:** **7FC7h** deletes data logger 1

**7FC8h** deletes data logger 2

**7FC9h** deletes data logger 3

**7FCAh** deletes data logger 4

### 3.16.2 Trigger Data Logger

You can use the following control codes from the controller, to have the operating device trigger a data logger to log a new value.

**Hexadecimal code:** **7FCBh** triggers data logger 1

**7FCCh** triggers data logger 2

**7FCDh** triggers data logger 3

**7FCEh** triggers data logger 4

### 3.16.3 Write Values of Running Time Meters to Controller

You can use the following control code from the controller, to have the operating device pass the values of the running time meters to the controller.

Only the values of active running time meters are transferred.

**Hexadecimal code:** **7FCFh**

### 3.16.4 Switch to Another Language

You can use the following control code from the controller, to have the operating device switch to another language.

The number of the language is the least significant digit of the hexcode.

Valid hexadecimal values for the language number are **7FE0h** to **7FEFh**.

Valid decimal values for the language number in the Language Parameters dialog are 1 to 16.

**Hexadecimal code:** **7FExh**

**Example 1:** You want to load the language with the number 4.

Write the hexadecimal number 7FE3 to the address of the serial message channel.

**Example 2:** You want to load the language with the number 12. Write the hexadecimal number 7FEB to the address of the serial message channel.

## 3.16.5 Automatic Data Release for Scanner Module

You can use the following control code from the controller, to have the operating device automatically read in the values from the connected scanner.

**Hexadecimal code:** **7FF2h**

## 3.16.6 Reload Event-Controlled Variable Values

You can use the following control code from the controller, to instruct the operating device to read all variable values from the controller again that are currently displayed in a mask and have the property Event-Controlled.

**Hexadecimal code:** **7FF3h**

## 3.16.7 Transfer Single Data Set from Operating Device to Controller

You can use the following control code from the controller, to have a single data set transferred from the operating device to the controller.

You must write the number of the data set to the variable defined for this purpose. In addition, you need to define the corresponding variables for the transfer buffers.

**Hexadecimal code:** **7FF4h**

## 3.16.8 Delete Acknowledged Messages from Serial Message Memory

You can use the following control code from the controller, to have all acknowledged messages of the operating device's serial message system erased.

In addition, the delete variable must contain the value **E216h**. This is to help avoid unintentional deletion. The delete variable is deleted in the system parameters for the serial message system.

**Hexadecimal code:** **7FF5h**

## 3.16.9 Cancel Printing the Print Log

You can use the following control code from the controller, to instruct the printer connected to the operating device to cancel the current print job for a print log.

**Hexadecimal code:** **7FF6h**

## 3.16.10 Printing a Print Log

You can use the following control code from the controller, to instruct the printer connected to the operating device to print the print log whose number was written to the variable defined for this purpose.

**Hexadecimal code:** **7FF7h**

The operating device will write one of the following four values back to the variable for the print log number to allow the print process to be monitored.

Table 3-29 Return values from operating device

| Value | Description |
|---|---|
| 0 | Print log printed with no errors. |
| 1 | Printing of the data set with the desired data set number is not possible |
| 2 | The selected print log does not exist. |
| 3 | Print process stopped. |

## 3.16.11 Printing a Data Set

You can use the following control code from the controller, to instruct the printer connected to the operating device to print the current data set.

**Hexadecimal code:** **7FF8h**

The operating device will write one of the following two hexcodes back to allow the print process to be monitored.

Table 3-30 Return values from operating device

| Value | Description |
|---|---|
| 0x0h | Data set printout OK |
| 0XFF | Printing of the data set with the desired data set number is not possible |

## 3.16.12 Set Clock in Operating Device

You can use the following control code from the controller, to have the operating device set the real time clock in the device as specified in a defined control word.

For the clock, the year can be set as two digits only.

**Hexadecimal code:** **7FF9h**

See chapter “Date and Time Image“ on page 3-128.

## 3.16.13 Data Set Transfer from Controller to Operating Device (Block Mode)

You can use the following control code from the controller, to have a data set transferred from the controller to the operating device. The data are transferred in block mode.

The number of the data set must be written to the variable defined for this purpose.

In addition, the corresponding variables for the transfer buffers must be defined.

**Hexadecimal code:** **7FFAh**

## 3.16.14 Data Set Transfer from Operating Device to Controller

You can use the following control code from the controller, to have the operating device transfer a data set from the operating device to the controller.

The number of the data set must be written to the variable defined for this purpose.

In addition, the corresponding variables for the transfer buffers must be defined.

**Hexadecimal code:** **7FFBh**

## 3.16.15 Send Keyboard Image to Controller

You can use the following control code from the controller, to have the current keyboard status transferred from the operating device to the controller.

**Hexadecimal code:** **7FFCh**

## 3.16.16 Data Set Transfer from Controller to Operating Device (Single Mode)

You can use the following control code from the controller, to have a data set transferred from the controller to the operating device. The data are read in single mode.

The number of the data set must be written to the variable defined for this purpose.

In addition, the corresponding variables for the transfer buffers must be defined.

**Hexadecimal code:** **7FFDh**

## 3.16.17 Erase Serial Message Memory

You can use the following control code from the controller, to have the entire message memory of the operating device's serial message system erased.

**Hexadecimal code:** **7FFEh**

## 3.16.18 Refresh Message System

You can use the following control code from the controller, to have the operating device load all new parallel messages.

This allows implementation of an event-controlled message system.

**Hexadecimal code:** **7FFFh**

## 3.17 Password Protection

Password protection prevents masks from being accessed and the data they contain from being altered without proper authorization. The protective function is available in every operating device. It is achieved by assigning access levels to masks and by using passwords.

Unless otherwise specified by the programmer, the access levels for all masks automatically default to the lowest level (=0). That means, no password is required to access masks with this access level.

Two authorization levels, referred to as the **edit level** and **view level**, are assigned to every password.

**View level**

**View level** means that the next mask can be viewed after the password is entered; but the values in it cannot be edited.

**Edit level**

**Edit level** means that the mask can be viewed after the password is entered and the values in it can be edited.

The following rules apply to passwords:

- Access is permitted if the view level and edit level values are greater than or equal to the values specified for the access level.
- The edit level must be equal or less than the view level.
- The higher the values for the view level and edit level, the higher the degree of authorization.
- The valid range of values for the view level and edit level is 0 to 255.
- The default setting for both is 0.
- The authorization levels are automatically set to 0 if you enter an incorrect password.
- If you select the Data Release key for an edit level that is too low, no function is implemented when you select the key.

You can enter a password in all masks. The only special case is the setup mask. The system variable **MskchgPasswd** is available for entry.

See chapter “MskChgPasswd“ on page 3-73.

In the programming software, you can select the Password Editor, which allows hidden password entry on the operating device. An X then appears for each character you enter in the operating device.

**Master Password**

During programming, we advise you to ensure that at least one password, a master password, has the highest authorization level. The first password entered in the programming system is of particular significance as a master password. Unlike all other passwords, the master password cannot be changed in the operating device. It also allows you to reset all changed passwords to the standard values entered in the programming software.

**Example for using access levels:**

Access level for mask 5 = 10

Access level for mask 6 = 20

Access level for mask 7 = 30

Password 4712 has the edit level = 15 and the view level = 25

The following accesses are possible after the password **4712** has been entered:

- Mask 5 will be displayed, editing of values is authorized.
- Mask 6 will be displayed, editing of values is **not** authorized.
- Mask 7 will **not** be displayed, editing of values is **not** authorized.

**Start-up mask**

The access level for the start-up mask is always 0.

**Setup mask**

The setup mask is an exception with regards to the password and external data release functions. Since no communication is taking place when the setup mask is displayed, the external data release function is not applicable.

To restrict access, passwords must be used!

By defining the die system variable **MskchgPasswd** as the first editable variable in the setup mask, all further variables can be protected against unauthorized access. The view level does not apply when accessing the setup mask. Viewing is always permitted if a value less than or equal to 254 is selected for the access level of the setup mask.

The edit level for all variables of the setup mask, with the exception of the system variable **MskchgPasswd**, is the same as that defined as the access level.

Access to the mask is always denied if an access level of 255 is defined for the setup mask. This means that the setup mask will no longer be displayed during initialization of the operating device and can therefore not be selected. However, all device-specific parameters can also be edited in any other mask. The new parameters become effective by restarting the operating device or with the system variable **Boot**.

## 3.17.1 Password Management

In the password management function of the programming software, you can define up to eight different passwords, each with a length of 11 characters. When you are allocating the different passwords, think of how you want to structure access authorizations.

Example:

- Password for the manufacturer of the plant, machine, and so on
- Password for on-site service
- Password for the person setting up the machine, foreman, overseer
- Password for the operator of the system

The passwords are stored in the operating device's Flash memory. These passwords are the basic setting that is active when you first start up the system after each download. The passwords are also stored in the operating device's RAM.

You can reactivate the passwords stored in the Flash memory by writing to the system variable **FlashPasswd**.

See chapter “FlashPasswd“ on page 3-74.

You can change all passwords from the operating device, except for the master password (first password in the list). To do this, write the password to be changed to the system variable **MskchgPasswd**.

See chapter “MskChgPasswd“ on page 3-73.

You must then write the new password twice to the system variable **ChangePasswd**. The new password is valid immediately, provided you enter the same new password twice. If this is not the case, a corresponding system message is issued and the password is reset.

See chapter “ChangePasswd“ on page 3-74.

Passwords are stored and compared as 11-character strings. Use the alphanumeric editor to enter the passwords in the operating device.

Program passwords globally, and not on a language-specific basis.

## 3.17.2 Reactivate Password Protection

The access authorization for a mask or variable is reset when the following is carried out:

- The operating device is switched off and back on again.
- The wrong password is entered.
- A logical 1 is written to the PR bit of the Write coordination byte.
- The system variable **MskchgResPasswd** is activated.
- The option Reset Password is selected in the mask parameters of the password-protected mask.

## 3.17.3 Password Mask and Password Functions

You can create a password query mask. This mask will then appear when you try to go to a password-protected mask, and you have not already entered a password with sufficient authorization.

As soon as you enter a password with sufficient authorization in the password query mask, and select the Data Release key, the system opens the mask previously selected. No restrictions apply to the other content (for example, texts, other variables, and soft keys) in the mask.

For each mask of the user interface, you can specify whether password protection will be activated after you exit the mask.

If the operator has not entered a valid password, it must be possible to exit the mask. You can program the cursor key Home to do this, for example.

If you do not create a password query mask, the operator must enter a password in masks specifically provided for this purpose.

You can deactivate password protection entirely by writing the value 1 to the system variable **PasswdInactive**.

See chapter “PasswdInactive“ on page 3-74.

The operating device then behaves as if each mask were created with an edit and view level of 0. The system variable is battery-backed, that is, the deactivation still has an impact after you switch on the operating device again.

## 3.18 Real Time Clock in the Operating Device

Each operating device has a real time clock. You set the parameters of the real time clock in the system parameters. You use system variables to set the time, date, and weekday in the operating device, and insert these variables in any mask.

You can transfer the data for the real time clock to the connected controller cyclically or on request, or provide values from the controller to the real time clock on request.

To allow the values to be exchanged, you must agree on a variable in which the image of date and time is stored. Enter the name of this variable in the system parameters of the real time clock either for setting the real-time clock or for transferring the real-time clock to the controller.

### 3.18.1 Date and Time Image

The time and date image describes the structure of the array variables that must be defined for setting and updating the time.

The date and time image is exchanged in the BCD format. For the image, you require an array variable with up to 8 bytes.

The length of the array variable is based on the length of the year specified.

The following table illustrates the image with a 4-digit year:

Table 3-31 Image of date and time with a 4-digit year

| | | | |
|---|---|---|---|
| Address + 0 | H | H | Century (00 to 99) |
| Address + 1 | Y | Y | Year (00 to 99) |
| Address + 2 | M | M | Month (01 to 12) |
| Address + 3 | D | D | Day (01 to 31) |
| Address + 4 | h | h | Hour (00 to 23) |
| Address + 5 | m | m | Minute (00 to 59) |
| Address + 6 | s | s | Seconds (00 to 59) |
| Address + 7 | W | W | Weekday (0 to 6 or 1 to 7) |

Table 3-32 Image of date and time with a 2-digit year

| | | | |
|---|---|---|---|
| Address + 0 | Y | Y | Year (00 to 99) |
| Address + 1 | M | M | Month (01 to 12) |
| Address + 2 | D | D | Day (01 to 31) |
| Address + 3 | h | h | Hour (00 to 23) |
| Address + 4 | m | m | Minute (00 to 59) |
| Address + 5 | s | s | Seconds (00 to 59) |
| Address + 6 | W | W | Weekday (0 to 6 or 1 to 7) |

The byte for the weekday is independent of the calendar and always runs Modulo 6. In this context, there is a difference between devices with Z80-CPU, 386-CPU, and RISC-CPU.

Create the names of the weekdays in a text list. To display the weekdays in the operating device, in any mask create the system variable **RTCDayofWeek** with the representation type **Selection Text**. Link this variable with the weekday text list.

You must order the names of the weekdays in the correct sequence. You can select any starting point.

Table 3-33 Text list for operating devices with a Z80-CPU or RISC-CPU

| Value | Text |
|---|---|
| 0 | Saturday |
| 1 | Sunday |
| 2 | Monday |
| 3 | Tuesday |

Table 3-33 Text list for operating devices with a Z80-CPU or RISC-CPU

| Value | Text |
|---|---|
| 4 | Wednesday |
| 5 | Thursday |
| 6 | Friday |

Table 3-34 Text list for operating devices with a 386 CPU

| Value | Text |
|---|---|
| 1 | Saturday |
| 2 | Sunday |
| 3 | Monday |
| 4 | Tuesday |
| 5 | Wednesday |
| 6 | Thursday |
| 7 | Friday |

## 3.18.2 Setting the Real Time Clock from the Controller

To update the real time clock data in the operating device from the controller, you must firstly create a variable in which the controller will store the date and time image. Enter this variable in the system parameters for the real time clock in the field **Setup**.

Finally, write the control code **7FF9h** in the serial message channel. This instructs the operating device to read the date and time image once from the agreed variable.

## 3.18.3 Transferring the Real-Time to the Controller

To transfer the real time clock data from the operating device to the controller, you must firstly create a variable in which the operating device will store the date and time image. Enter this variable in the system parameters for the real time clock in the field **Update**.

Then specify a polling time with which you want the operating device to write data at cyclical intervals into the variable.

## 3.19 Help System

For each mask and each input variable in the project, you can create a help mask, and link these masks with each other. If you do not create or link any help masks, the default help mask is displayed.

The help texts are always limited to the size of one single mask.

### 3.19.1 Default Help Mask

The default help mask is always displayed if you have not linked any help mask to the mask or input variables. The default help mask is always available and only displays a blank page if it is not programmed.

### 3.19.2 Help Mask for Masks

You can create a separate help mask for each mask.

You can link the help mask with the mask using the mask parameters.

If the operator is in a mask and data release has not been requested, the help mask appears for this mask for the length of time you select the Help key, or after he has chosen a button that has been programmed accordingly.

In order for the button to simulate the key function of the Help key, you must create the Help key using the **key simulation** function, and link it with the system variable **KeyHelp**.

See chapter “KeyHelp“ on page 3-70.

### 3.19.3 Help Mask for Input Variable

You can create a separate help mask for each input variable.

You can link the help mask with the variable using the variable parameters.

If the operator is in a mask that contains a variable and data release has been requested, the cursor must be located at the variable. In this case, the help mask appears for the length of time he presses the Help key, or presses the button that has been programmed accordingly.

The help mask for an input variable is specifically designed for specifying the permitted range of values for the current input variable.

In order for the button to simulate the key function of the Help key, you must create the Help key using the **key simulation** function, and link it with the

system variable **KeyHelp**.

See chapter “KeyHelp“ on page 3-70.

## 3.19.4 Help Mask for Message Masks

You can only create one help mask for a mask that contains a message field. You cannot call a help mask for any programmed input variables in the message mask.

If the operator is in a mask which contains a message field and data release has not been requested, the help mask appears for this mask for the length of time you select the Help key, or after he has chosen a button that has been programmed accordingly.

In order for the button to simulate the key function of the Help key, you must create the Help key using the **key simulation** function, and link it with the system variable **KeyHelp**.

See chapter “KeyHelp“ on page 3-70.

## 3.20 Print Logs

A print log is made up of the printer page layout, static texts, and output variables. Print logs cannot contain graphic elements.

The print logs cannot be displayed on the operating device. Instead, they are only managed by the operating device and output using the interface SER2.

The logs do not necessarily have to be output to a printer. The data sent can also be read in by a higher-level system (host computer) and processed further to any degree.

A prefix and a postfix can be selected for each individual print log.

Prefixes and postfixes are control sequences that are transferred before and after the actual print log. The sequences are entered in a list within the system parameters for the print logs.

To ensure that print logs have a uniform layout, and to simplify the input of elements that are always the same, you can create sub-print logs, and link them with the print log.

You can use the following options to select default settings for the Print Log Editor.

- Font
- Grid/grid color
- Color of non-printable elements
- Color of output variables
- Zoom factor when opening the Log Editor

In the system parameters, you can select other settings for print logs.

- Page settings for the printer
- Symbolic name for the transfer variable of the log number
- Length of transfer variables
- Escape sequences for the printer

### 3.20.1 Escape Sequences for Print Logs

You can have one or several escape sequences sent to the printer before (prefix) and/or after (postfix) each print log. You can use these to:

- Generate a line feed
- Generate a page feed
- Change font
- Change font size
- Change font style

See the printer documentation for more information on the escape sequences you can define for your logging printer.

Enter the escape sequences with a unique name in a list. This list is then

available for selecting the attributes for a print log.

## 3.21 System Parameters

The system parameters which you can specify in the programming software are stored in the operating device. You can set system parameters for the following areas:

- General parameters
- Polling area
- Terminal clock
- Running time meters
- Message system
- Variant options
- Password management
- Communication SER2
- Gateway
- Data set transfer
- Parallel outputs
- Touch screen and
- Print logs

### 3.21.1 General Parameters

Specify a time period in seconds for the polling time of the cyclical variables. Another data exchange process with the controller takes place after this time has elapsed.

Selecting the **Enable Automatic Download** check box will cause the operating device to automatically detect and activate downloading, without having to switch the corresponding user mode switch on the operating device. This function can only be used if a project with this setting has been loaded into the operating device using the standard procedure.

The same conditions apply to the **Enable automatic upload** check box.

Select the **Deactivate password function if mask change is initiated by PLC** check box if

- The mask change is to be initiated by the controller.
- A currently active password protection for the controller is to be deactivated.
- You still want the operator to have to enter passwords to be able to access the same mask.

Select the **Enable mask change for active editor** check box if you want to allow the operator to change to another mask even when the data release is active.

The **Screen Saver** area allows you to determine if

A. no screen saver is to be used
B. the screen saver is to be activated for masks without cyclical variables only
C. the screen saver is to be activated for masks with cyclical output variables also

The turn-on time for the screen saver specifies the time interval allowed to elapse after the last action before the display of the operating device is blanked. The LED in the help key will flash during this time.

The screen saver is not available for use in all operating devices. Therefore, while options for selection will be available, a delay time cannot always be entered.

The **Input Variables** area allows you determine if

A. the input variable is to be displayed in inverse format while it is edited
B. pressing the Enter key lets you go to the next input variable

The **Table Editor** area allows you to determine if the cursor is to advance to the next row or the next column when you press the Enter key.

The **Symbolic addresses for...** area allows you to enter symbolic addresses for the image of the mask number, the image of the DIP switch (user mode switch), the Read coordination byte, the table index and the image of the keyboard.

## 3.21.2 Polling Area

The polling area consists of three segments:

1. Read coordination byte (1 byte or 1 word)
2. Serial message channel (2 bytes or 1 word)
3. Segment for controlling the status LEDs in the function keys

You can

– operate the entire polling area with a single field variable OR
– operate each segment of the polling area with separate variables.

If you operate the polling area with 1 variable:

1. Specify the name of the variable for the polling area.
2. Specify the polling time.
3. Specify the size of the polling area.

If you operate the polling area with 3 variables:

1. Specify the name of the variable for the Read coordination byte.
2. Specify the name of the variable for the serial message channel.
3. Specify the name of the variable for controlling the status LED in the function keys

See chapter “Read Coordination Byte“ on page 3-108.
See chapter “Write Coordination Byte“ on page 3-110.
See chapter “The Cyclical Polling Area“ on page 3-113.
See chapter “Status LEDs of Function Keys“ on page 3-106.

### 3.21.3 Terminal Clock

Here you can specify the name of the variable used for the data associated with the date, the time and the day of the week in the controller as well as the polling time for data exchange.

Select the elements that are to be transferred. If no element is selected, no data transfer will take place. For the date, choose whether you want the year to be transmitted as a 2 or 4-digit value.

The terminal clock can be set from within the controller. For this purpose, a variable must be specified, where the time to be set is stored.

See chapter “Set Clock in Operating Device“ on page 3-122.
See chapter “Real Time Clock in the Operating Device“ on page 3-128.
See chapter “Date and Time Image“ on page 3-128.
See chapter “Setting the Real Time Clock from the Controller“ on page 3-130.
See chapter “Transferring the Real-Time to the Controller“ on page 3-130.

### 3.21.4 Running Time Meters

Eight running time meters are available in the operating device.

For the control byte, enter the variable name which constitutes the address where the controller can influence the running time meters in the operating device.

If bit X is set in the control byte when polling is carried out, the running time meter X is incremented.

Using the address of the variable in the Reset Byte field, you can reset the running time meters in the operating device.

The polling time specifies the time intervals at which the operating device refreshes the running time meters.

The running time meters are activated in the operating device as soon as you have entered a variable name for the control byte and specified a value for the polling time. If the polling time is 0 or if there is no address for the control byte, the Running Time Meter function in the operating device is off.

You can specify an address in the controller for each running time meter. The operating device stores the value of the corresponding running time meter to this address when requested by the controller to do so. For this purpose, the controller needs to write the hexadecimal code **7FCFh** into the serial message channel of the polling area.

For each variable, you must provide a 32-bit memory area in the controller!

See chapter “Running Time Meter“ on page 3-107.
See chapter “Write Values of Running Time Meters to Controller“ on page 3-120.

## 3.21.5 Message System

You can specify general parameters and parameters for the serial and the parallel message system.

**General Parameters**

You can enter a message number to display a message directly. The message number also indicates its priority. The lowest message number has the highest priority and the highest message number has the lowest priority.

All messages that have a higher priority than the message number specified here are handled using a special procedure in the operating device when they appear. These messages are indicated by flashing of the status LED in the direct selection key of the message mask or are signaled by a system message.

Using the Size of Message Buffer, you define how many messages can be stored in the operating device. Specify the maximum number of messages to be managed by the operating device.

You can have the messages displayed in indented format. To do so, specify the number of characters by which the lines are to be indented after the first line. The value you enter here refers only to the display of messages in the operating device's message field.

The same options are available for outputting messages to the logging printer.

You can choose from four variants for outputting to the printer.

1. Print the entire message, SER2 reserved exclusively for message output
2. Formatted printout, SER2 reserved exclusively for message output
3. Print the complete message, SER2 reserved only temporarily for message output
4. Formatted printout, SER2 reserved only temporarily for message output

**Serial Message System**

From the controller, you can **erase all acknowledged messages** if you write the bit pattern **E216h** to the controller address **Delete Messages** and write the control code **7FF5h** to the serial message channel.

If you want to **delete all messages**, you need to write the control code **7FFEh** to the serial message channel. If you want to use this function of the operating device, you must assign a variable for deleting messages.

**Parallel Message System**

For the parallel message system, you must enter a Variable for Status Messages as the start address of the data area where the messages are stored in the controller in bit-coded form.

You can also specify a name for a Variable for Acknowledging Status Messages of the same size.

You also define the number of bytes to define the Size in Bytes of the area for the status messages in the controller.

You can define a maximum of 256 bytes for this area.

By entering the polling time, you also specify the interval at which the oper-

ating device reads the data area of the status messages from the controller.

For the polling time, you can enter values from 0 to 25.5 seconds.

The active messages are displayed in an I/O screen with a message field for parallel messages. The status messages can be sorted according to various criteria.

See chapter “Delete Acknowledged Messages from Serial Message Memory“ on page 3-121.
See chapter “Erase Serial Message Memory“ on page 3-124.
See chapter “Serial Message System“ on page 3-159.
See chapter “Parallel Message System (Status Messages)“ on page 3-161.

## 3.21.6 Variant Options

Variant options are required if you want to

– implement a selection field to allow selection of variants in your project
– allow the number of fractional digits (precision) to be influenced depending on the variant used
– implement different user interface systems depending on the variant used

The variant selection can be configured in the Variant Buffer area.

Enter the name of the variable for the variant buffer. In addition, you need to specify the size of the buffer in bytes.

The maximum buffer size is 32 bytes.

The variant buffer is read only once during the initialization phase!

Using the variant buffer, you transfer a sequence of binary values to the operating device in order to enable or disable elements of a variant selection.

**Example for variant selection**

In the Fractional Digit Control area, enter the name of the variable that is used to define the number of places to follow the decimal point (fractional digits) globally. For variables, it is possible to specify the following for the formatting: fractional digits + offset or fractional digits – offset. The offset is entered into this variable.

If 2 fractional digits are specified for variable display and the variable for the fractional digit control contains the value '1', the following applies:

for + offset - 3 digits after the point are displayed (XXXX.xxx)

for - offset - 1 digit after the point (XXXX.x).

**Example for factional digit control**

In the Mask Reference List Control area, enter the name of the controller variable you want to use to specify the mask number.

### 3.21.7 Password Management

The password management function basically consists of an assignment of passwords to authorization levels.

See chapter “Password Protection“ on page 3-125.

### 3.21.8 Communication SER2

The operating device is equipped with a RS232 interface. This interface is used when the project is downloaded/uploaded during the programming phase. During normal operation, use the connection for a logging printer or a scanner.

Depending on the operating device, the interface is designed as a 9-pin or 25-pin DSUB plug-in connector.

The X3 / SER2 interface defaults to the following values when the programming system is started for the first time.

Table 3-35 Default values for SER2

| Parameter | Value |
|---|---|
| Baud rate | 19200 Baud |
| Parity | Odd |
| Data bit | 7 |
| Stop Bits | 1 |
| Handshake | Software handshake |

You can also configure the interface for a scanner.

#### 3.21.8.1 Connecting a Scanner

You need to define a number of parameters before a scanner can be connected via the X3 / SER2 interface of the operating device.

These parameters initialize the scanner and define the specific data transfer information.

The parameters entered cannot be validated since you cannot select a specific scanner type.

You can connect any scanner with a RS232 interface that transmits ASCII characters.

In the **Scanner Parameters** area, you define a default and initialization parameter.

In the **Default** field, you enter an ASCII string that activates the scanner.

In the **Initialization** field, you enter an ASCII string that configures the scanner.

For more detailed information on initializing the scanner, please refer to the documentation provided by the scanner manufacturer.

For current information on how to use a scanner, refer to the online help of the programming software.

## 3.21.9 Gateway

Specifying gateway parameters is only relevant for operating devices that are equipped with the necessary firmware.

You can specify the following parameters for these devices:

- Smallest possible slave number
- Largest possible slave number
- Polling time for text list
- Cache size
- Polling time for cache
- Variable for cache address
- Variable for network status address.

## 3.21.10 Data Set Transfer

The variables for the data set transfer are required when you intend to use recipes in your project. These variables are used to handle the data set transfer from the operating device to the controller.

A data set is clearly identified in the operating device by a unique recipe number and data set number.

The first two variables are used when the operator wants to transfer a data set from the operating device to the controller. These variables allow the controller to identify the data set being transferred. The transfer is initiated by a bit in the **Read coordination byte**.

The two bottom variables allow the controller to request the transfer of a data set from the operating device. For this process, the controller writes the recipe number and the data set number of the respective data set to the two variables and signals the request via a bit in the **Write coordination byte**.

## 3.21.11 Parallel Outputs

You can define a cyclical variable for the parallel outputs allowing you to control eight binary outputs via the operating device.

Specify the polling time for the repetition rate at which the variable is read from the controller.

Choose the outputs you want to influence.

The cyclical variable addresses a word (2 bytes) in the controller. Two bits of this word correspond to one output.

The following bit combinations apply:

Table 3-36 Truth table for a parallel output

| Bit 1 | Bit 2 | Status of the LED |
|---|---|---|
| 0 | 0 | OFF |
| 0 | 1 | OFF, FLASHING is preset |
| 1 | 0 | ON |
| 1 | 1 | FLASHING |

## 3.21.12 Touch Parameters

You can define the following default settings for touch-sensitive operating devices:

- Default sound
- Duration of the sound
- Default image for system icon.

**Default sound:** This is the default setting for the signal tone that sounds when the button is pressed.

The following options are available:

- No sound
- Sound when pressed
- Sound when released
- Sound when pressed and released
- Continuous sound while pressed.

**Duration of the sound:** Enter a time in seconds.

**Default image for system icon:** Enter the default image here that is needed when system icons are used.

## 3.21.13 Print Logs

The general print log parameters include the printer setup (page settings) and the variables defining the transfer of the print log number from the controller to the operating device.

For the printer Page Settings you can specify the Lines in Page and Charac-

ters in Line.

For detailed information on defining the page size, please refer to your printer manual.

A variable must be defined to be able to transfer the print log number from the controller to the operating device. If the controller transmits a command to print a print log, the operating device uses the log number currently stored in this variable.

To initialize the print log from the controller, the control code **7FF7h** must be written to the polling area.

The operating device writes the status of the print process to the same controller address.

The following statuses are transferred:

Table 3-37 Parameters for print logs

| Value | Status |
|---|---|
| 0 | Printing complete |
| 1 | Printer in use |
| 2 | Print log not found |
| 3 | Print log stopped |

## 3.22 Message System

The message system is an integral part of the user interface. Messages are reactions to events that are communicated to the operator in an intelligible form. A distinction is made between internally and externally generated messages, depending on where the event occurred. The diagram below shows the structure of the message system.

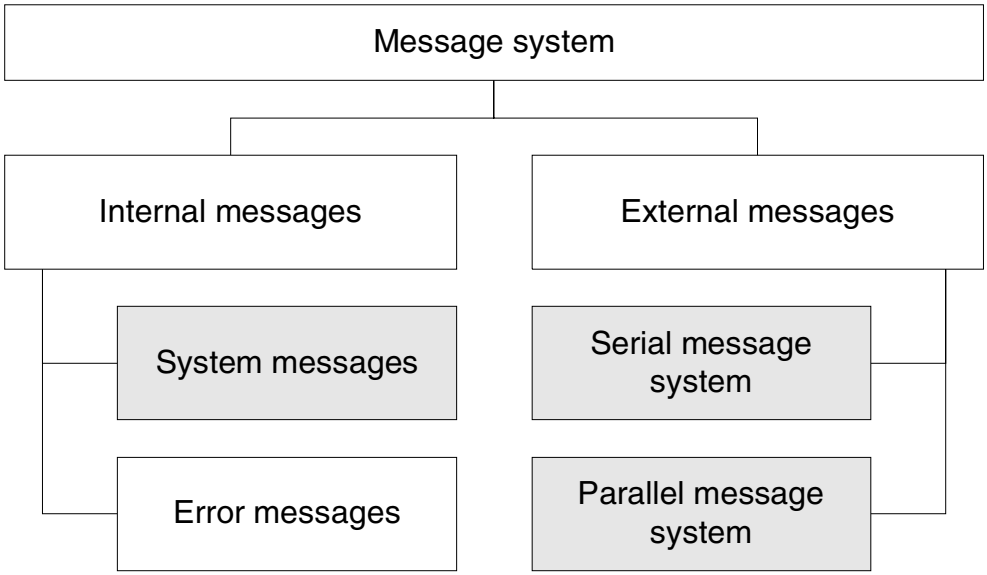



Figure 3-26 Structure of the messages system

The areas shown in gray color can be freely designed during programming.

### 3.22.1 Internal Messages

Internal messages are all messages that are generated by the operating system. A distinction is made between system messages and error messages. The user (programmer) cannot influence the generation of these messages.

### 3.22.2 System Messages

System messages are generated by the operating system as a result of internal plausibility checks. A system message is activated immediately after the corresponding event has occurred.

Pending system messages are signaled to the operator

– by a flashing Help key status LED and
– setting the system variable **StateHelp** to the logical value '1'.

The message text of the system message is displayed if you

– press the Help key or
– press a corresponding button.

For key-operated devices, the system message is displayed for the length of time the key is pressed. For operating devices with a touch screen, you can

configure an input/output mask specifically for displaying system messages. The button in which the system variable **StateHelp** is configured can at the same time be used to change to this mask.

If several system messages are pending at the same time, they will be displayed in the order of their system numbers. The system message number "1" represents the highest priority.

You can change the text of the system messages to suit you needs. The size of one screen is available for each system message text. The system message text can be freely designed using the terminal-specific fonts. Additional character attributes or graphics are not possible.

Icons are available for system message display on operating devices equipped with a touch screen. This allows system messages to be displayed graphically.

The texts are output in a language-specific manner, i.e. if the user interface is multilingual, the system messages are displayed in accordance with the selected language. The system message assignment is carried out by means of system message numbers. The system message number stands for a predefined event.

A brief description consisting of 20 characters is used to provide an explanation of the system number. The length of the texts is designed to allow them to be displayed on one line, even on the smallest operating device's display.

A newly created system contains the following system messages with brief descriptions:

Table 3-38 System Messages

| Number | Brief Descriptions |
|---|---|
| 1 | Wrong format |
| 2 | Value too large |
| 3 | Value too small |
| 4 | Replace battery |
| 5 | Message overflow |
| 6 | New message |
| 7 | Message buffer full |
| 8 | Invalid mask no |
| 9 | Invalid message no. |
| 10 | Print log invalid |
| 11 | Interface in use |
| 12 | Invalid password |
| 13 | Password unchanged |
| 14 | Overvoltage |
| 15 | Data set protected |

Table 3-38 System Messages

| Number | Brief Descriptions |
|---|---|
| 16 | Illegal data set |
| 17 | Data set unknown |
| 18 | Data set memory full |
| 19 | Data set active |
| 20 | Data set transfer |
| 21 | Password missing |
| 22 | Editing mode active |
| 23 | Data set file error |
| 24 | Data set format |
| 25 | Number invalid |
| 26 | Loop-through active |
| 27 | No data set address |
| 28 | Recipe unknown |
| 29 | Data set download |

### 3.22.2.1 System Message 1 - Wrong format

You are attempting to enter an invalid data format into a variable field of the numerical editor. For example, the number of places entered before the decimal point exceeds the setting specified in the user interface.

### 3.22.2.2 System Message 2 - Value too large

You are attempting to enter a value into a variable field of the editor that exceeds the variable's upper limit. The upper limit is defined in the user interface.

If you delete the system message text from the user interface, no system message will be issued, but the maximum permitted value will be entered instead.

### 3.22.2.3 System Message 3 - Value too small

You are attempting to enter a value into a variable field of the editor that is below the variable's lower limit. The lower limit is defined in the user interface.

If you delete the system message text from the user interface, no system message will be issued, but the minimum permitted value will be entered instead.

### 3.22.2.4 System Message 4 - Replace battery

A test performed on the battery indicated that its capacity has fallen below the limit value. This test is repeated every 60 minutes. To avoid loss of data when replacing the battery, the information in the respective operating device's user manual must be complied with.

The same message appears when you remove the battery, switching the device off at this point will, however, result in the battery-backed data being lost!

### 3.22.2.5 System Message 5 - Message overflow

Indicates that the system is unable to process the external messages quickly enough. Upon display of this message, one message has already been lost.

### 3.22.2.6 System Message 6 - New message

This text is displayed when the operating device has received a new external message whose priority exceeds the programmed threshold value and no direct selector key has been assigned to the message mask.

### 3.22.2.7 System Message 7 - Message buffer full

This text is displayed as a warning that the next external messages may overwrite the oldest or lowest-priority messages (depending on the configuration).

### 3.22.2.8 System Message 8 - Invalid mask no

This text is displayed to indicate that a non-existing mask number has been transmitted by the controller via the serial message channel.

### 3.22.2.9 System Message 9 - Invalid message no.

This text is displayed to indicate that the controller has transmitted a message number that does not exist in the user interface.

### 3.22.2.10 System Message 10 - Print log invalid

The operator or the controller attempted to start a print log that does not exist in the user interface.

### 3.22.2.11 System Message 11 - Interface in use

Interface X3 is already being used by another print job. You are attempting to transmit different types of data to the printer at the same time (e.g. to print

recipes and messages).

### 3.22.2.12 System Message 12 - Invalid Password

You entered a password which does not exist in the password management function. With this message, the previous access authorizations (view and edit level) are reset.

### 3.22.2.13 System Message 13 - Password unchanged

The operator did not enter the same new password twice in a row.

### 3.22.2.14 System Message 14 - Overvoltage

The operating device has detected that the supply voltage is too high. Switch the device off immediately to avoid damage. Check supply voltage.

### 3.22.2.15 System Message 15 - Data set protected

You attempted to modify individual values of a data set stored in the Flash or to delete the entire data set.

### 3.22.2.16 System Message 16 - Illegal data set

The data set number you specified as the destination for the data set copy process exists already or is outside the valid range (for example, Flash). The upload destination for a data set transfer is invalid (e. g. zero).

### 3.22.2.17 System Message 17 - Data set unknown

The data set with the number you selected does not exist in the data set list.

### 3.22.2.18 System Message 18 - Data set memory full

You attempted to create a new data set but the data set memory is full.

### 3.22.2.19 System message 19 - Data set active

You attempted to erase or to copy to the active data set, or to select a data set even though the active data set is currently being edited.

### 3.22.2.20 System Message 20 - Data set transfer

You attempted to initiate a data set transfer to the controller even though the previously initiated transfer has not yet been completed.

### 3.22.2.21 System Message 21 - Password missing

You attempted to switch to a password-protected mask or to edit a password-protected mask without having entered a password with sufficient authorization.

### 3.22.2.22 System Message 22 - Editing mode active

You attempted to change to another mask while the operating device was in editing mode.

### 3.22.2.23 System Message 23 - Data set file error

The data set file loaded from the PC to the operating device contains a syntax error. The error can be located by means of the line number system variable.

### 3.22.2.24 System Message 24 - Data set format

The size or internal version identifier of a data set loaded from the PC to the operating device and the corresponding values in the programming software do not match.

### 3.22.2.25 System Message 25 - Number invalid

The bit pattern read from the controller is not valid for a floating point number. The number is output as 0,0.

### 3.22.2.26 System Message 26 - Loop-through active

The selected action was not performed due to an active loop-through operation.

### 3.22.2.27 System Message 27 - No data set address

The addresses for the data set transfer did not exist at the time of the controller's request.

### 3.22.2.28 System Message 28 - Recipe unknown

You attempted to select a recipe that does not exist in the operating device.

### 3.22.2.29 System Message 29 - Data set download

You initiated a data set transfer to the controller (download), but the Data Set Download Release bit in the Write coordination byte (bit 4) has not yet been set by the controller.

### 3.22.2.30 System Message 30 - Scanner error

Three different types of errors may have occurred:

1. A value was scanned, but the editor required was not open yet.
2. The scanner does not support this variable type.
3. The parameter settings for the scanner (prefix and postfix) are not correct.

### 3.22.2.31 System Message 31 - Print log unknown

You selected a print log that does not exist.

### 3.22.2.32 System Message 32 - Error on changing the language

The language number you want to switch to, does not exist.

### 3.22.2.33 System Message 33 - Flash card information

The following errors may have occurred:

– Data error while downloading a project from the Compact Flash card.
– You inserted the Compact Flash card into the operating device.
– You removed the Compact Flash card from the operating device.

You can use the system variable **CFCardError** to display the type of error.

See chapter “CFCardError“ on page 3-92.

### 3.22.2.34 System Message 34 - New appl. necessary

The project in the operating device or the project in the controller has been modified and the operating device is trying to access variables that meanwhile have been modified.

## 3.22.3 Suppressing the Display of System Messages

You can prevent system messages from being displayed by deleting the corresponding text. The entry of the system message in the project management function remains existent.

**Example:** System message 7 - "Message buffer full" is to be suppressed. Older messages or messages with a lower priority are to be overwritten.

Delete the system message text in the project management function.

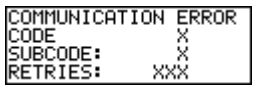
By suppressing the display of this system message, the user agrees that incoming messages automatically overwrite the oldest messages or those

with the lowest priority once the message buffer is full.

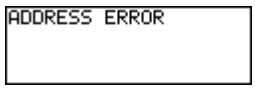
### 3.22.4 Error messages

The messages listed here are displayed by the operating system in English. The size of the texts has been chosen in such a way that they can be displayed on every operating device.

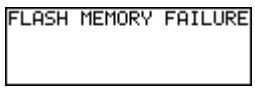
The text output cannot be suppressed and the texts cannot be modified. The term "error message" is used because the terminal does not operate in accordance with the true meaning of the standard mode while these messages are displayed. In addition to true system errors, various conditions and processes are also described.



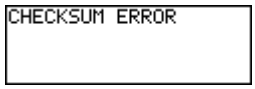

This message is generated for all types of protocol and interface errors. The error codes (CODE X) and SUBCODE (X) are protocol-specific and are listed in the respective description in the chapter on controller and bus connections. The connection with the communication partner has been interrupted. RETRIES displays the number of unsuccessful attempts to establish a connection. This number is incremented while the device is running. The number of retries depends on the protocol that is being used.



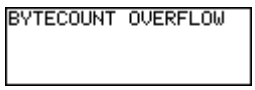

This message may be displayed during a download. The S3 file addresses physical addresses in the operating device. The transmission is aborted as soon as invalid addresses are detected during this process. The starting address of the invalid line in the S3 file is specified in hexadecimal format.




Is displayed during a download if the Flash Eprom cannot be programmed. This message indicates that the application memory is defective. The starting address of the invalid line in the S3 file is specified in hexadecimal format.

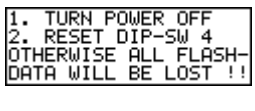



Error during transmission of the application description. The error has either occurred during the serial transmission or the S3 file contains invalid lines or no valid S3 file has been transmitted. Recompile the application description and attempt to retransmit.




Error during transmission of the application description. An error was detected in the S3 file of the application description. More bytes were received in one of the transmission lines than specified in the byte count.

Transmission format of the application description contains errors. The output file used has not been generated by this programming system. The transmitted file did not contain S0, S3 or S7 lines, no S3 format was used.




The user mode switch S4 was at the "on" position when the supply voltage for the operating device was switched on. The Flash data will be retained if the following instructions are complied with. Switch the device off, set S4 to "off" position, switch device on - data will be retained and the device will function as before. If S4 is set to the off-position while power is on - data will be lost, the device switches to the download mode!

The version of the programming system and the operating system in the operating device are not compatible. This error occurs if the wrong operating system version was selected for compilation of the application description. The two program versions must match.

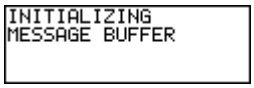
The protocol driver loaded via the programming system and the operating device's operating system do not match. The two program versions must match.

The parameters of the interface SER1 (X2) were modified. To achieve an operational connection, both communication partners must be set to the new parameters. This message is used for informational purposes if the connection to the communication partner cannot be established.

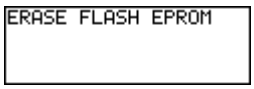
The operating system cannot find a protocol driver in the application description loaded. Select a protocol, recompile the application description and activate another download.

The protocol selected in the programming system when creating the application description and the operating device's hardware are not compatible. For example, the Interbus protocol driver has been loaded to a device with standard interfaces.

A self-test is performed and the keyboard is checked when the operating device is switched on. Make sure no keys are pressed during this process. Please follow the request. If this message is issued when no key is pressed, it indicates that the keyboard is defective!

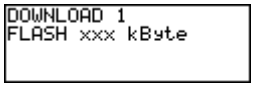



When the operating device is switched on, all messages in the operating device are sorted. This initialization process requires a certain length of time based on the number of stored messages. The message is always generated, but is only displayed for a very short time period or is not visible at all.

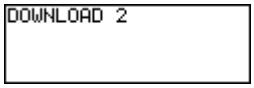



Is displayed while the mask memory is being erased. All of the programmed data are erased at this point.

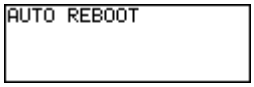
This message appears after the delete process is completed. Interface SER2 (X3) is initialized for download operating mode.




The operating device indicates that it is ready for a download with a baud rate of 19200 Bd via interface X3. A new project can now be loaded or new interface parameters for the transfer can be exchanged.



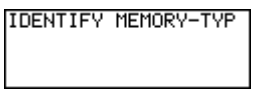

The operating device indicates that it is ready for a download with the new interface parameters. If no data are received within 20 s, the operating device will return to the DOWNLOAD 1 state.



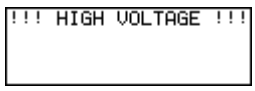

The operating device will reboot after a few seconds.

The operating device reports its parameters during the startup process:

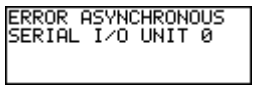
- CPU frequency in MHz
- Size of Flash memory in Kbytes
- Version number XXXXXXXX
- Loaded PLC driver YYYYYYYY




The Flash memory type used is being identified.




The voltage applied to the operating device is too high! This message will not disappear until the specified supply voltage has been reached.

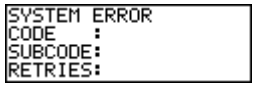



Initialization of the serial interface (unit 0 or unit 1) failed.

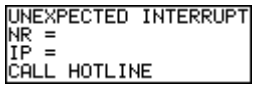
The program release of the SUCOnet K card and the current protocol driver are not compatible. Retrofit the operating device or use the appropriate driver version. The subcode specifies the level of the SUCOnet K card.

The program level of the keyboard card and the current firmware are not compatible. Retrofit the operating device. The subcode specifies the level of the keyboard card.

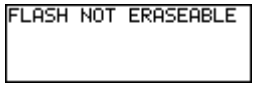
Indicates a successful update operation. The operating device reboots automatically.



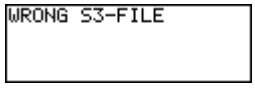

A fatal error has been encountered. If this error message is displayed, contact Sütron electronic GmbH, Kurze Str. 29, 70794 Filderstadt, Germany, hotline no.: +49 (0) 7 11 / 7 70 98 55. Before calling, make a note of the firmware and hardware version.



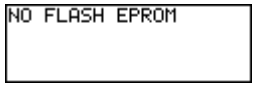

An unexpected interrupt has occurred. Contact Sütron electronic GmbH, Kurze Str. 29, 70794 Filderstadt, Germany, hotline no.: +49 (0) 7 11 / 7 70 98 55. Before calling, make a note of the interrupt number (NR) and the program counter number (IP).



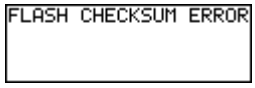

Is displayed after the device has been switched on or prior to a download to indicate that the Flash Eprom cannot be erased.



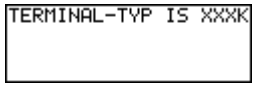

Is displayed at the beginning of a download to indicate that the S3 file is not the correct type for the operating device being used.



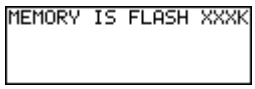

This message is displayed to indicate that no Flash supported by the programming algorithm can be detected.




The application description stored in the FLASH contains errors. This error may occur at the end of a transmission, e.g. if the transmission was incomplete or after a device, with a defective memory, is switched on.

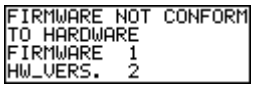



An attempt has been made to load a S3 file which was intended for another device type. When this error occurs, the correct type for this operating device is displayed where "XXXX" appears. Recompile using this selection in the programming system.

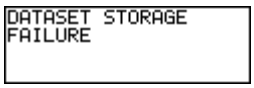



An attempt has been made to load a S3 file which was created for a larger mask memory. The amount of memory space requested by the S3 file and the memory available in the terminal do not match. When this error occurs, the memory size available in the device is specified, in Kbytes, where "XXX" appears. This value must be specified in the programming system when compiling.

An error message that should never occur, but which exists nevertheless. The terminal's operating system generates this error if proper operation is no longer possible due to a lack of plausibility. To be able to reproduce the incident, we need to know the code and subcode number as well as the software versions of the operating system and programming software. Do not hesitate to call our hotline and we will help you.




If this error message is displayed, contact Sütron electronic GmbH, Kurze Str. 29, 70794 Filderstadt, Germany, hotline no.: +49 (0) 7 11 / 7 70 98 55. Before calling, make a note of the firmware and hardware version. The operating system of the operating device switches into an endless loop to prevent damage to the device.




A checksum error was detected when checking the memory areas of the recipe data sets. Either the battery or the RAM memory is defective.

## 3.22.5 External Messages

External messages are generated by the connected controller and forwarded to the operating terminal as information on the monitored process. The user can choose two separate message systems. Depending on the requirements, message transfers to the operating device can be either serial or parallel. This is regardless of whether the messages are process messages or fault messages.

Messages can consist of the message text and a scaled and formatted variable. Every variable type available in the system is valid.

The information in the message memory can be used for statistical evaluations. The message is assigned between the operating device and the controller by means of a message number. The associated texts and variable specifications are stored in the operating device together with the application description. The function of a message and its contents are determined by the user when the application description is created in the programming system.

All of the external messages are stored in the message memory in chronological order or in order of priority. You can optionally store parallel messages in the serial message memory to ensure that they are evaluated statistically as well. If the message contains a variable, its value will be frozen in the message memory.

### 3.22.5.1 Structure of an External Message

An external message is made up of the following:

- A message number from 1 to 9999
- Date
- Time
- Message text with up to 255 characters
- The values of up to two variables, from the time the message appears (only if available)

When a new project is being created, existing messages can be transferred individually or completely.

#### 3.22.5.1.1 Message Number

For external messages, the message number also determines the priority of the message. The message with the number 1 has the highest priority, and the message with the number 9999 has the lowest priority. You do not have to assign continuous message numbers.

The assignment of the message numbers in the area for status messages always starts with 1.

Make sure that the serial and parallel message systems do not overlap!

If you want both message systems to be independent of each other, make sure that the message numbers of the serial system start above the status messages.

If you would like to program full-page message outputs, you must harmonize the message and mask numbers.
See chapter “Full-Page Message Output“ on page 3-160.

From the system, you can also use status message texts in the serial message system.

#### 3.22.5.1.2 Message Text and Variable

The text length must not exceed 255 characters, including a formatted variable. The programming system will not allow you to enter texts longer than this.

The standard size of all characters of the operating device specified in each case is permitted. Each message text can contain two output variables.

The output format of the variables is identical to the one-off output variables in input/output masks. In this way, for example, coded texts can be used to modify individual messages or to use them for several statuses.

The output format of the message line can be changed online in a configuration mask for the message mask.

The same options exist for serial and parallel messages.

**Example:** Complete message format:

| No. | Date | Time | Text 1 | Variable 1 | Text 2 | Variable 2 |
|---|---|---|---|---|---|---|
| **1234** | **25 Aug 92** | **11:30:00** | **Temperature** | **285** | **°C at station** | **07** |

Explanation of the message structure:

| | |
|---|---|
| 1234 | 4-digit message number |
| 25 Aug 92 | Date - is recorded when the message is detected in the operating device |
| 11:30:00 | Time - is recorded when the message is detected in the operating device |
| Temperature | Text 1 in front of variable 1 |
| 285 | value of variable 1 at the time of message generation, is stored in the operating device |
| °C at station | Text 2 between variable 1 and 2 |
| 07 | value of variable 2 at the time of message generation, is stored in the operating device |

### 3.22.5.2 Size of Message Memory

The maximum message memory size allows management of up to 3000 message entries. As the amount of data is considerable, a high performance level is required when sorting the messages, and during resorting and initialization.

As you usually do not require this many entries, you can set the maximum memory size for messages as needed. The basic setting for the message memory allows 500 entries.

When making the setting, take note that for example, you will need about 50 pages of paper to print an entire message memory containing 3000 messages.

The message buffer is output in the message mask. You can use a system variable to define message sorting.

### 3.22.5.3 Message Sorting

You can optionally display messages in the message mask according to their time of arrival or according to their priority. The desired sorting option can be selected when the system is programmed.

If both possible message systems are used, it is possible to select the sorting settings separately. The settings are stored in the system variables **RepmanRepSortCrit** and **RepmanSortCritP**. You can use these system variable to change the settings online on the operating device (using a configuration mask, for example).

If you do not give the operator a configuration option, the preselected sorting settings will apply.

Sorting options for the serial message system:

0 - by priority

1 - by time of arrival (most recent first)

2 - by time of arrival  (oldest first)

3 - by group

Sorting options for the parallel message system:

0 - by priority

1 - by time of arrival (most recent first)

2 - by time of arrival (oldest first)

3 - by group

### 3.22.5.4 Message Priority for Direct Display

The priority of a message is determined by its message number.

The higher the message number, the lower the message priority.

The value that represents the upper limit for the message number that is to be indicated on arrival by a flashing LED or by outputting a system message can be entered into the system parameters of the message system.

If you enter the value 0, you will not be notified of newly arrived messages!

### 3.22.5.5 Printing the Message Memory

The memory contents of the serial and parallel message systems can be printed either in full or in part.

The entire content of the message memory of the **serial** message system is printed if the system variable **PrintAllRep** is set to the value '1' (formatted printout) or the value '2' (full-length printout).

The entire content of the message memory of the **parallel** message system is printed if you press a softkey or button linked to the system variable **PrintAllState**.

To print the message memory in part, the messages to be printed must be selected in the message mask. This is done by pressing the Data Release key in the message mask (or a corresponding button) and selecting the messages in the message field using the Cursor Up and Cursor Down keys.

The print job is started by pressing a soft key (or button) linked to the system variable **BlockPrint** (prints visible part of the selected block) or **BlockPrintLong** (prints messages of the selected block in full length). The system variables can additionally be included in a configuration mask and be edited online.

### 3.22.5.6 Direct Call of the Message Mask

In the programming software, you can link a function key or button with a

message mask. You can use this function key (the button must be available in each mask) to go from each mask to the message mask. As well as accessing the message mask from a selection menu, you can then also use the function key to access the message mask. The integrated LED of the function key then takes on the task of indicating when new messages have been received. In this case, the LED flashes when a new message has been received.

When you select the flashing function key, the system goes directly to the message mask. When you select the function key again, the system automatically returns to the previous mask. The usual flashing help key LED is not available when programming a function key.

### 3.22.5.7 Message Output Formats

The following information is available for each external message:

- Message Number
- Date
- Time
- Message text
- The values of up to two variables, from the time the message appears (only if available)

You can use different system parameters to influence message display in a message mask or on a printer. You can set these parameters online in a programmed configuration mask.

System variables are then used to select and deselect message elements.

Table 3-39 System variables for messages

| Serial Messages | Parallel Messages | Affects |
|---|---|---|
| RepoutNr | RepoutNrP | Message Number |
| RepoutDate | RepoutDateP | Date |
| RepoutTime | RepoutTimeP | Time |
| RepoutAnzYear | RepoutAnzYearP | 2-digit or 4-digit display of the year |

You can select or deselect individual message elements to influence the length of a message line. These settings do not influence the information saved.

The following output variants are available for selection:

Complete message format:

| No. | Date | Time | Text 1 | Variable 1 | Text 2 | Variable 2 |
|---|---|---|---|---|---|---|
| **1234** | **25 Aug 92** | **11:30:00** | **Temperature** | **285** | **°C at station** | **07** |

Variants:

**1234 25 Aug 92 Temperature 285 °C at station 07**

**1234 11:30:00 Temperature 285 °C at station 07**

**1234 Temperature 285 °C at station 07**

**25 Aug 92 11:30:00 Temperature 285 °C at station 07**

**11:30:00 Temperature 285 °C at station 07**

**25 Aug 92 Temperature 285 °C at station 07**

**Temperature 285 °C at station 07**

### 3.22.5.8 Zooming Messages

Messages are displayed in a one-line format in the message mask for the sake of clarity. In order to display a longer message in its full length, the message must first be selected and then the Enter key pressed.

Line of the message mask on an operating device displaying 20 characters per line:

**1234 25 Aug 92 11:30:00 Station 137**

Zoomed view:

**1234 25 Aug 92 11:30:00**

**Station 137 in the furnace has a**

**temperature of 285 °C**

The zoomed view remains active for as long as you hold the Data Release key down. With smaller displays (for example, with 4 x 20 characters) only the message text is zoomed. The device type that is to be used must be considered when the text is programmed, to ensure the lines are wrapped correctly.

### 3.22.5.9 Acknowledging Messages

Message acknowledgment in the controller can be carried out by means of variables. Various editors or function keys (soft keys) are suitable for this purpose. The acknowledgment enables the controller to delete the message and initiate another verification.

## 3.22.6 Serial Message System

Two bytes are reserved in the cyclical polling area for the transfer of serial messages. These two bytes are referred to as the 'serial message channel'. The byte order depends on the selected data type of the polling area (see Polling Area). The controller writes a 16 bit message number in this message channel.

The operating device polls the entire polling area of the controller at cyclical intervals and transfers the serial message in the process.

Upon detecting a message (message number > 0), the operating device stores this message in the internal message memory and resets the serial message channel in the controller to zero (0). The value 0 indicates to the controller that the message has been picked up by the operating device. The polling time for the serial message channel is configurable.

The same procedure is used to address external masks and message masks. Whenever the number transmitted corresponds to a mask number,

this mask is displayed. If a mask and a message text exist for this number, the mask (message mask, full-page fault message text) is displayed and the associated message text is entered into the message memory.

Make sure that the message number is always written to the serial message channel with a 16 bit command!
As a result of asynchronous processing of some data transfer protocols, evaluation of the message number may lead to problems if the message number has been entered with single-byte commands.

### 3.22.6.1 Full-Page Message Output

The full-page message is a combination of message processing and external mask selection.

For full-page message mask output, a mask and a message text must be programmed with the same number.

The controller calls up the 'external mask' through the serial message channel. When it is called up, the mask is displayed and the associated message text is entered into the message memory. As you can choose the display content freely, it is possible to implement a message mask, full-page error output or other content types.

To be able to return to the previous mask from here, at least one mask parameter must be programmed with the function 'previous mask'. Message masks can also consist of several masks or even complete structures for troubleshooting. A separate, full-page help text can be configured for each full-page message.

### 3.22.6.2 Outputting Messages to a Logging Printer

When serial messages are logged directly, the printer always runs synchronously. Every new message arriving via the serial message channel is printed immediately and is transferred to the message memory in parallel. Here, attention must be paid that the printer can only process one print job at one time. Every print request must be ended before any further print request is started by the system.

You can influence message output to a printer with the system variable **RepmanRepPrint**.

The settings that apply when the formatted type of printout is selected are the same as those selected for the display of messages in the message mask.

The settings for the printout can be changed online on the operating device.

As the output consists of a pure text file, the message can also be read by a host computer or a PC. With a further system variable **PrintAllRepLong**, the full length of the message can be output.

### 3.22.6.3 Erasing the Message Memory Externally

The internal message memory of the serial message system can be erased externally, that is from the controller. To do this, a symbolic variable name for the delete variable must be specified in the Message System option of the system parameters in the programming software. Two bytes are needed in the controller for the variable.

The operating device always checks the delete variable in the controller once it has received the delete sequence (write the control code **$7FFE_H$** to the serial message channel). The internal message memory is erased when the delete variable contains the bit pattern **$E216_H$**. The delete variable increases protection against unintentional deletion.

If deletion is not required, you should reset the variable or specify no symbolic name in the programming software.

## 3.22.7 Parallel Message System (Status Messages)

The parallel message system supplements the serial message system. The messages are transferred in parallel and evaluated in the operating device. In this context, the current message status is compared with the previous status in the operating device. The messages that no longer exist are automatically deleted from the memory, and new messages are added to the memory. The current status of the messages can be output.

All messages have a date and time, to enable you to determine when a message appeared for the first time.

The length of the message buffer cannot exceed 256 bytes.

Set the length in the system parameters for the message system in the programming software. Certain restrictions may apply to the length, depending on the protocol used.

Status messages are only retained in the message memory for the length of time they are reported by the controller. To set up a message system with acknowledgment, you must have the messages of the parallel message system written to the serial message memory. You must set the transfer of a message from the parallel to the serial message memory separately for each message.

Status messages can be transferred on a time- and/or event-controlled basis.

### 3.22.7.1 Settings for Status Messages

#### 3.22.7.1.1 Size in Bytes

Enter the size of the parallel message system in bytes. You can transfer eight status messages per byte. The absolute size depends on the data type used (address of the variables). For example, the number of bytes is always rounded up for a word address.

The maximum size for the parallel message system is limited to 256 bytes.

Depending on the operating device, different storage quantities are available, which are also used differently for messages and data sets.

This is how you determine the memory requirement in your operating device:

Table 3-40 Memory space / memory requirement

| | **CPU in Operating Device** | | |
|---|---|---|---|
| | **Z80** | **386** | **32 Bit RISC** |
| Available Memory Space in Bytes | About 116000 | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement per Message (=1 Memory Location) | 24 Bytes | 32 Bytes | 32 Bytes |
| Memory Requirement per Data Set without User Data | 33 Bytes | 39 Bytes | 44 Bytes |

You must expect **three times the memory requirement** for the following message variants:

1. Messages containing 2 variables
2. Messages with 'Appear/Disappear'
3. Messages with acknowledgment ('Appear/Disappear' active).
4. Messages whose first variable has a size of greater than 4 bytes

The following table illustrates the memory use for 500 messages and a maximum number of data sets containing 22 bytes of user data:

Table 3-41 Memory use for 500 messages

| | **CPU in Operating Device** | | |
|---|---|---|---|
| | **Z80** | **386** | **32 Bit RISC** |
| Available Memory Space in Bytes | About 116000 | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement per Message in Bytes | 24 x 500 = 12000 | 32 x 500 = 16000 | 32 x 500 = 16000 |
| Remaining Memory Capacity in Bytes | 104000 | 100000 | About 100000 for FW version 1.07 or lower<br>About 12*4000 for FW version 1.08 or higher |
| Possible Number of Data Sets | 104000 / (22+33) = **1890** | 100000 / (22+39) = **1639** | 100000 / (22 + 44) = **1515** for FW version 1.07 or lower<br>1294000 / (22+44) = **1960** for FW version 1.08 or higher |

You can use the following formula to determine the exact message buffer size:

**G >= M1 + M3 + 20**

G = Size of message buffer

B = Size of parallel message system in bytes

M1 = Number of messages which: require only 1 memory location, are entered in the message editor and have message numbers smaller than B x 8

M3 = Number of messages which: require 3 memory locations, are entered in the message editor and have message numbers smaller than B x 8

20 = Minimum size of message buffer

#### 3.22.7.1.2 Polling Time

The polling time determines the intervals at which the variables for status messages are read again.

#### 3.22.7.1.3 Variables for Status Messages

You must specify the memory address for the parallel message system as a symbolic variable in the system parameters for messages . All variable types that the controller can access bit-by-bit, and the operating device can access byte-by-byte or word-by-word are permitted.

Table 3-42 Structure of variables for status messages with 2 bytes

| **Word** | **High Byte** | | | | | | | | **Low Byte** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Byte** | **2** | | | | | | | | **1** | | | | | | | |
| **Bit** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| Message no. | 16 | 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

A bit set in a byte activates the corresponding status message in the operating device.

#### 3.22.7.1.4 Variable for Acknowledging Messages

The variable for acknowledging messages has the same structure as the variable for the messages themselves.

Each bit set in a byte represents the acknowledgment of the corresponding message.

## 3.23 Recipes

Various logically related variables can be organized into units known as recipes. Unlike mask variables, recipe variables are not transferred to the controller immediately after being entered, but are stored in the operating device as data sets. These data sets are protected against power failure. The data sets can be loaded to the controller as a unit as and when required.

The maximum number of recipes that can be created at programming time is 250. For each recipe, up to 250 data sets can be created. The data sets can either be created at programming time and be stored in the operating device's Flash memory together with the project or can be entered online on the operating device and are then stored in the battery-backed RAM.

You must copy data sets stored in the Flash memory to the RAM first before you can edit them. Data sets that have been edited remain in the battery-backed RAM.

Example for using recipes:Settings of a machine for manufacturing various products

Table 3-43 Recipe for the product 'clamp'

| Variable | Value | Unit |
|---|---|---|
| Material | ST37-3 | |
| Feedrate | 25,00 | mm/s |
| Setpoint Value Axis 1 | 43,5 | mm |
| Setpoint Value Axis 2 | 56,30 | mm |
| Cutting Angle | 30 | ° |
| Cutting Speed | 110 | mm/s |

Table 3-44 Recipe for the product 'shaft'

| Variable | Value | Unit |
|---|---|---|
| Material | X20Cr13 | |
| Feedrate | 20,00 | mm/s |
| Setpoint Value Axis 1 | 45,6 | mm |
| Setpoint Value Axis 2 | 51,20 | mm |
| Cutting Angle | 45 | ° |
| Cutting Speed | 76 | mm/s |

The variables Material, Feedrate, Setpoint Value Axis 1, Setpoint Value Axis 2, Cutting Angle and Cutting Speed can be organized into the recipe "Machine Settings for Products".

The variables Feedrate, Setpoint Value Axis 1 and Setpoint Value Axis 2 are defined as floating point numbers or fixed point numbers. The variable Cutting Angle is defined as an integer and the variable Material as a selection text (coded text).

The values for manufacturing the products Clamp and Shaft must be stored as data sets. Whenever another product is to be manufactured, the data set of the product to be manufactured next can be loaded into the controller.

The following check list contains all of the elements that are required and useful for creating and handling a recipe with data sets:

– The recipe itself (texts and variables)

- Data sets with data set number, data set name and variable offset
- I/O mask for the recipe
- Recipe field in the mask
- Recipe buffer (address for the data area in the controller)
- Variable Data Set Number for Transfer from operating device
- Variable Recipe Number for Transfer from operating device
- Variable Data Set Number for Request from controller
- Variable Recipe Number for Request from controller
- System variables:

Table 3-45 System variables for recipes

| System Variable | Linked to | Description |
|---|---|---|
| SelectDSNr | Selection Text/Decimal Number | Display/Select Data Set Number |
| SelectDSName | Selection Text Variable | Display/Select Data Set Names |
| DestDSNr | Positive Decimal Number | Destination Data Set Number for Copy Process |
| DSCopy | Softkey / Selection Text Variable | Activate 'Copy Data Set' |
| DSDelete | Softkey / Selection Text Variable | Delete Data Set |
| DSDownload | Softkey / Selection Text Variable | Load Data Set in Controller |
| DSDnloadBreak | Softkey / Selection Text Variable | Stop Data Set Transfer |
| DSDnloadState | Selection Text Variable | Display Transfer Status |
| ActDSName | Alphanumeric Variable | Enter Name for RAM Data Set |
| SelectRezeptNr | Selection Text/Decimal Number | Display/Select Recipe Number |
| TabPgUp | Softkey | Page Up |
| TabPgDn | Softkey | Page Down |
| Break | Softkey | Cancel Input |
| LoadDSName | Selection Text Variable | Display Name of Last Data Set Transferred |
| StartSave | Softkey / Selection Text Variable | Data Set Transfer from Operating Device to PC |
| SaveState | Selection Text Variable | Display Transfer Status |
| StartRestore | Softkey / Selection Text Variable | Data Set Transfer from PC to Operating Device |
| RestoreState | Selection Text Variable | Display Transfer Status |
| RestoreLineNr | Positive Decimal Number | Display Current Transfer Line |
| StartRezPrint | Softkey / Selection Text Variable | Print Active Data Set |
| RezPrintState | Selection Text Variable | Display Printer Status |

Table 3-45 System variables for recipes

| System Variable | Linked to | Description |
|---|---|---|
| StartUpload | Softkey / Selection Text Variable | Data Set Transfer from Controller to Operating Device |
| UploadDSNr | Positive Decimal Number | Destination Data Set Number for Upload |
| UploadState | Selection Text Variable | Display Transfer Status |

## 3.23.1 Structure of a Recipe

A recipe comprises a maximum of 255 variables. In addition, up to 255 explanatory texts can be programmed. The variables and texts can be spread out over a maximum of 255 lines (with each line stretching across the entire width of the screen). A help text can be programmed for every variable.

The recipe is displayed in a recipe field, within an I/O mask, that extends over the entire width of the screen. The height of the recipe field can be as small as one line or as large as the entire height of the screen. The Cursor keys can be used to scroll through long recipes in the recipe field.

All one-line display formats can be used for recipe variables. Multiple-line formats can not be used (for example, multiple-line selection fields, tables, etc.). In addition, neither variables nor texts can be displayed with the zoom option.

## 3.23.2 Working with Recipes and Data Sets

The majority of the operations described below refer to the active data set. In order to activate a data set, first select the recipe to which it belongs and then the data set itself. How to select recipes and data sets is explained in the next two sections.

### 3.23.2.1 Selecting a Recipe

Each recipe is assigned a number from 1 to 250 when the recipes are programmed.

You can select a recipe as follows:

– By means of a fixed assignment between the recipe and a mask. This means, that whenever you open the corresponding mask, the recipe field will contain the recipe that was specified when programming was carried out. If you do not permanently assign a recipe to a mask with a recipe field during the programming phase, the last recipe that was processed appears when the mask is opened.

– By means of the system variable **SelectRezeptNr**. You can edit the system variable using any Editor. It is a good idea, however, to use a selection text (coded text) and assign meaningful recipe names to each recipe number.

See chapter “SelectRezeptNr“ on page 3-77.

### 3.23.2.2 Selecting a Data Set

Data sets can be assigned both a number from 1 to 250 and a name.

You assign the data set numbers and names when the data sets are created, in other words either when programming is carried out for the data sets stored in the Flash memory or on the operating device in the case of data sets stored in the RAM. The maximum data set name length is 15 characters. Data set names need not necessarily be unique (though it is recommended that they are).

You can select a data set as follows:

– Select a new recipe. The associated data set with the lowest number is then selected for the new recipe automatically.
– By means of the system variable **SelectDSNr**. You can edit this system variable only as a selection text. In this case, only the numbers of those data sets that are available for the active recipe are displayed.
– By means of the system variable **SelectDSName**. You can edit the system variable only as a selection text. In this case, only the names of those data sets that are available for the active recipe are displayed.

See chapter “SelectDSNr“ on page 3-76.
See chapter “SelectDSName“ on page 3-76.

### 3.23.2.3 Copying a Data Set

You can only copy the active data set. To do so, write the number of the destination data set to the system variable **DestDSNr** and then write the value 1 to the system variable **DSCopy**.

The following conditions must be fulfilled in order for the data set to be copied successfully:

– The number of the destination data set must be in the range of 1 to 250.
– There must not already be a data set with the same number for the active recipe (unless **DSCopy**is set to 3).
– The active data set cannot be edited at the same time.
– There must be enough free RAM on the operating device.

If any of these conditions is not satisfied, the data set is not copied and a system message is output.

The destination data set becomes the active data set after it has been copied.

After it has been copied, the name of the destination data set consists merely of blanks. You can use the system variable **ActDSName** to change the name.

See chapter “DestDSNr“ on page 3-76.
See chapter “DSCopy“ on page 3-76.
See chapter “ActDSName“ on page 3-77.

### 3.23.2.4 Deleting a Data Set

You can only delete the active data set. To do so, you need to write the value 1 to the system variable **DSDelete**.

The following conditions must be fulfilled in order for the data set to be deleted successfully:

– The active data set cannot be edited at the same time.
– The data set must be stored in the RAM.

If any of these conditions is not satisfied, the data set is not deleted and a system message is output.

After the deletion, the data set with the lowest number in the current recipe becomes the active data set.

See chapter “DSDelete“ on page 3-77.

### 3.23.2.5 Modifying a Data Set

The active data set can be modified, providing it is stored in the RAM.

To change the contents of a data set, the variables must be edited in the recipe window. Note, however, that the new values are not written in the data set as soon as the Enter key is pressed, but are first stored in a temporary buffer.

The Data Release key must then be pressed in order to enter them into the data set. If the new data is not to be entered, the system variable **Break** can be set to 1 to discard the contents of the buffer. For ease of use, you might want to program one of the softkeys or a specific button to the system variable **Break**.

You cannot select another data set until the buffer contents has either been accepted or discarded.

If the controller changes to a different mask while a data set is being modified, or if the external data release is canceled again before you press the

Data Release key, the buffer contents will likewise be discarded.

The modified data set is not transferred to the controller automatically. An explicit command from you or the controller is necessary first.

See chapter “Break“ on page 3-84.
See chapter “Transfer Single Data Set from Operating Device to Controller“ on page 3-121.

### 3.23.3 Data Set Transfer to/from Controller

You can load the data sets in the operating device to the controller. You can also load (any changed) data sets from the controller to the operating device. In this context, the data set transfer is always initiated by the operating device, but only when the controller has activated the corresponding release (Data Set Download Release bit in the Write Coordination byte).

### 3.23.3.1 Transfer to the Controller (Operator-Controlled)

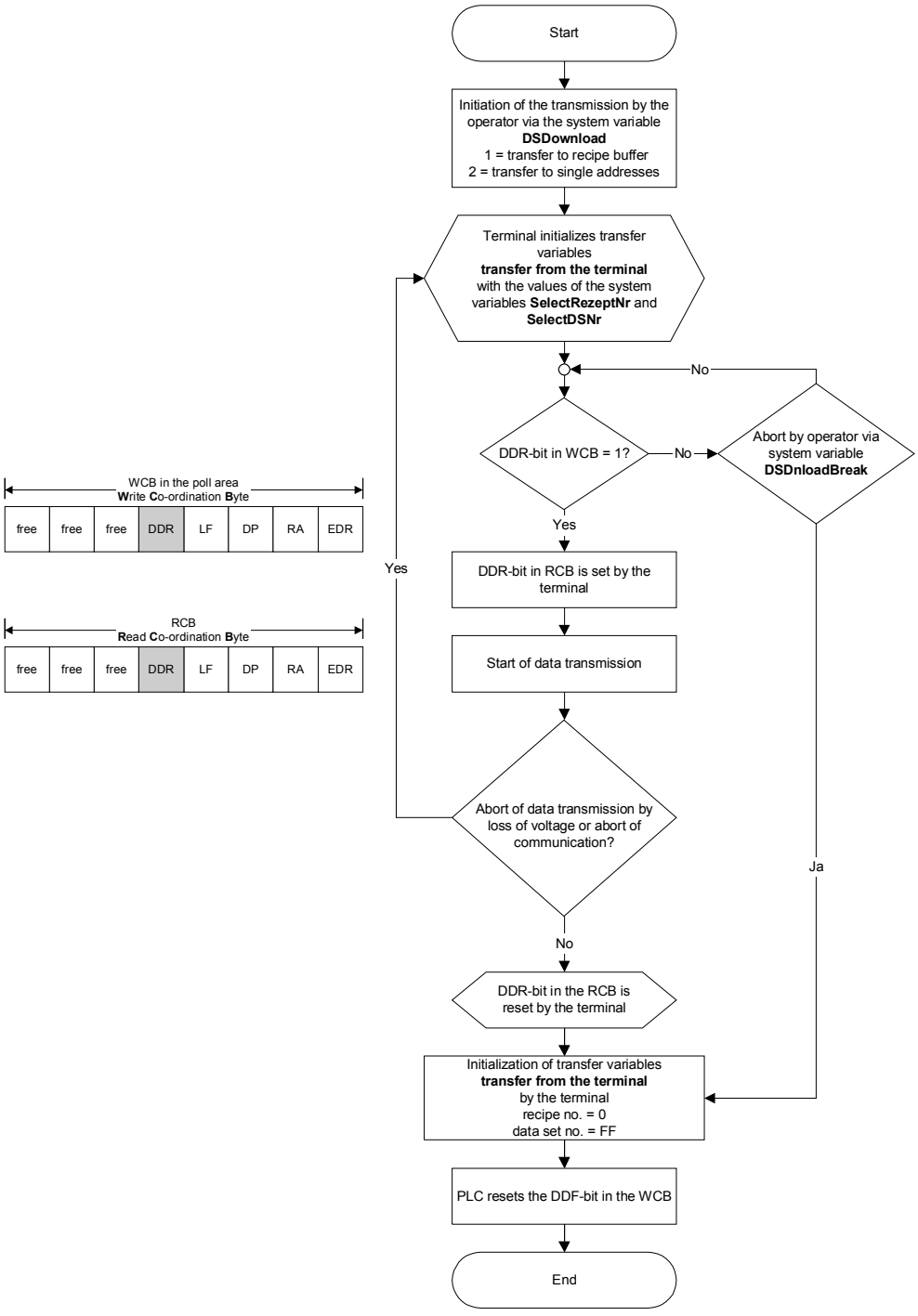

Start
Initiation of the transmission by the operator via the system variable **DSDownload**
1 = transfer to recipe buffer
2 = transfer to single addresses
Terminal initializes transfer variables **transfer from the terminal** with the values of the system variables **SelectRezeptNr** and **SelectDSNr**
No
DDR-bit in WCB = 1?
No
Abort by operator via system variable **DSDnloadBreak**
Yes
DDR-bit in RCB is set by the terminal
Start of data transmission
Abort of data transmission by loss of voltage or abort of communication?
Yes
Ja
No
DDR-bit in the RCB is reset by the terminal
Initialization of transfer variables **transfer from the terminal** by the terminal
recipe no. = 0
data set no. = FF
PLC resets the DDF-bit in the WCB
End
WCB in the poll area
**W**rite **C**o-ordination **B**yte
free free free DDR LF DP RA EDR
RCB
**R**ead **C**o-ordination **B**yte
free free free DDR LF DP RA EDR

Figure 3-27 Data transfer to the controller (operator-controlled)

### 3.23.3.2 Transfer to the Operating Device (Operator-Controlled)

Start
Upload to ...?
new data set
existing data set
Recipe buffer
Upload from .. ?
PLC single address
Recipe buffer
Upload from .. ?
PLC single address
Initialization of the system variable **StartUpload** with the value 4 by the operator
Initialization of the system variable **StartUpload** with the value 3 by the operator
Input of the destination data set number via the system variable **UploadDSNr**
Input of the destination data set number via the system variable **UploadDSNr**
Initialization of the system variable **StartUpload** with the value 2 by the operator
Initialization of the system variable **StartUpload** with the value 1 by the operator
Not enough memory?
Yes
Yes
Not enough memory or data set is protected?
No
No
Data transmission to the next free data set within the terminal memory
Indication of the error message via the status-LED "Help"
Data transmission to the data set which is defined in the system variable **UploadDSNr**
End

Figure 3-28 Data transfer to the operating device (operator-controlled)

### 3.23.3.3 Transferring Data Sets to / from a PC

It is possible to transfer data sets to or from a PC via the interface X3, in order to back up the data sets that have been stored in the operating device, process the data or supply the operating device with new data sets.

It is also particularly important to back up the data sets if a new application description is loaded in the operating device, as all the data sets in the RAM are then deleted. If the recipe structure remains unchanged, however, they can be reloaded into the operating device again after the application description has been loaded. If changes have been made to the structure of any of the recipes (number of variables, position of the variables in the data

set buffer, etc.), only the data sets of the other, unchanged recipes can be reloaded into the operating device .

The data sets are transferred in a format that can be edited using a Text Editor (see section 3.8.4.3 Structure of the Data Set File).

The parameters for the X3 interface can be freely configured by means of the corresponding system variables. Merely make sure that the same parameters are set at the PC end. You can send or receive at the PC end with any suitable program, such as Windows Terminal (1).

### 3.23.3.4 Transfer to a PC

The transfer of data sets to the PC is initiated by writing a value to the system variable StartSave. The number of data sets that are transferred depends on the value that is written to the system variable. The following are valid values:

System variable value = 1: Only the active data set is transferred.

System variable value = 2: All of the data sets of the active recipe are transferred.

System variable value = 3: All of the data sets of all recipes are transferred.

The process can be monitored by the operator with the aid of the system variable SaveState.

### 3.23.3.5 Transfer from a PC

The operating device is placed to the Ready-to-Receive state when the system variable StartRestore is set to 1. The data sets can then be sent by the PC. The operating device recognizes the end of the data set transfer automatically by analyzing the data it has received. It then returns to its normal state.

To cancel the Ready-to-Receive state again without receiving data, the value of the system variable StartRestore must be changed to 2.

The system variable RestoreState indicates whether or not the terminal is ready to receive.

If a formatting error is detected in the received data, a system message to this effect is output and the receive process is terminated. The position of the formatting error can be located, at least approximately, with the aid of the system variable RestoreLineNr. This system variable contains the number of the last line to have been received.

Data sets can only be stored in the operating device if their structure is still identical to the data set structure specified for the corresponding recipe in the application description. This can be checked by the operating device on the basis of a version number (see Structure of Data Set File). If a data set which is found to be invalid is received, it is rejected and a system message to this effect is output. The receive process is not terminated, however.

If a data set with the same number as the transferred data set is already stored in the Flash Eprom, the newly received data set is rejected without any warning to the operator.

If a data set with the same number as the transferred data set is already stored in the RAM, a parameter setting in the received data (see Structure of Data Set File) determines whether or not the existing data set is overwritten. If it is not supposed to be overwritten, and another data set with the same number already exists in the operating device, the newly received data set is similarly rejected without any warning to the operator.

### 3.23.3.6 Structure of a Data Set File

The data sets transferred to the PC are generally stored in a file.

If this file is only used for backup purposes, the operator does not necessarily be familiar with its structure. In this case, the file can merely be transferred back to the operating device unchanged when it is needed.

If the data are to be processed further, for example, within the scope of production data acquisition, the user should understand the structure of the file.

All of the data in the data set file are represented by a simple language specifically developed for this purpose.

The following are elements of this language:

**Key words:** S + two further letters. They normally appear at the beginning of a line. Example: SDW or SFA

**Decimal number:** Any number of the digits 0-9, preceded by a negative sign when required. Example: 999 or -1234567

**Hexadecimal number:** H + any number of the digits 0-9 or letters A-F or a-f. Example: H999 or H123abCD4

**Hexadecimal string:** C + any even number of the digits 0-9 or letters A-F or a-f.

Example: C12 or CAAFF33

**ASCII string:** Any string of characters enclosed between two backslash characters (\) .

Example: \This is one ASCII string\

**Comment:** Any string of characters enclosed between two dollar signs ($). Comments can be inserted in the data set backup file at any position and can stretch across several lines.

Example: $This is a comment$

Any number of separators (blanks, tab characters or line feed characters) can be placed between these language elements.

The above-mentioned language elements are used to create a file with the following structure:

– Start of file identifier
– Any number of data sets
– End of file identifier

A data set consists of:

– Data set header
– Any number of data set variables
– End of data set identifier

Table 3-46 Start of file identifier

| **Start of File Identifier** | |
|---|---|
| Key | SFA |
| Parameter | none (date and time are output by the operating device as a comment) |

Table 3-47 End of file identifier

| **End of File Identifier** | |
|---|---|
| Key | SFE |
| Parameter | none |

Table 3-48 Data set header

| **Data Set Header** | |
|---|---|
| Key | SDK |
| Parameter | Recipe number, data set number, data set name (as an ASCII string), data set size in bytes, recipe version number, write-over identifier |

Table 3-49 Data set variables

| **Data Set Variables** | |
|---|---|
| Key | SDW |
| Parameter | Offset of the variables in the recipe, variable size in bytes, value of the variables (as a hexadecimal string) |

Table 3-50 End of data set identifier

| **End of Data Set Identifier** | |
|---|---|
| Key | SDE |
| Parameter | none |

Explanations:

**Recipe version number**

On creating or changing the recipe description in the programming software, this version number is increased automatically whenever the structure of the data sets has changed. To be able to load a data set from the PC to the operating device, the downloaded version number and the version number stored in the operating device for the recipe involved must match. The

downloaded data set will not be stored if the version numbers do not match.

**Write-over identifier:** The value 1 means that the downloaded data set is to overwrite any data set with the same number that may already exist in the operating device. The value 0 means that the downloaded set is to be rejected if a data set with the same number already exists. Only those data sets can be overwritten that are not stored in the Flash memory, i.e. that were loaded into the operating device together with the project.

### 3.23.3.7 Printing Data Sets

The data set printout can be started from both the operating device and the controller.To be able to initiate a printout from the operating device, either the system variable **StartRezPrint** must be placed into a mask or a soft key must be assigned accordingly. The active data set can be printed via interface SER1 by writing the value 1 to the system variable. Writing the value 2 to the same system variable will cancel the print process. A heading including the recipe number, data set number and data set name will be printed at the beginning of each data set. The status of the print process can be displayed through the system variable RezPrintState. To be able to control a print job from the controller, the data set number and recipe number must be entered into the appropriate variables first. The print job is then started by writing the value **7FF8H** to the address of the serial message channel.

A value of 0 (zero) in the variable for the recipe number (for request from the operating device) will indicate that the data set is being printed.

If another print job is currently being printed so that the printer can not print the specified data set, the value 255 will be written to the variable for the recipe number (for request from the operating device).

### 3.23.3.8 Memory Requirement for Data Sets

The RAM in the operating device that is not required by the system (approximately 110000 bytes) is used to store messages as well as data sets that have been stored in the RAM.

The size of the message buffer is configurable. Each message takes up 24 bytes. This makes a total of 12000 bytes for the default message buffer size (500 messages), so that a further 98000 bytes are available for storing data sets.

Space is also needed to store the data set name and management information (additional 28 bytes per data set).

Example:

If the data set size is programmed as 22 bytes, a total of

98000 / (22 + 28) = 1960

data sets can be saved in the RAM (message buffer size: 500). Other, fixed programmed data sets can also be stored in the Flash Eprom.

## 3.24 Memory Requirement for Messages and Data Sets

Depending on the operating device, different storage quantities are available, which are also used differently for messages and data sets.

Table 3-51 Memories in operating devices in comparison

| | Z80-CPU | 386-CPU | 32 Bit RISC CPU |
|---|---|---|---|
| Available Memory Space in Bytes | About 116000 | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement per Message (=1 Memory Location) | 24 Bytes | 32 Bytes | 32 Bytes |
| Memory Requirement per Data Set without User Data | 33 Bytes | 39 Bytes | 44 Bytes |

You must expect three times the memory requirement for the following message variants:

1. Messages containing 2 variables
2. Messages with 'Appear/Disappear'
3. Messages with acknowledgment ('Appear/Disappear' active).
4. Messages whose first variable has a size of greater than 4 bytes

The following table illustrates the memory use for 500 messages and a maximum number of data sets containing 22 bytes of user data:

Table 3-52 Memory use for 500 messages in comparison

| | Z80-CPU | 386-CPU | 32 Bit RISC CPU |
|---|---|---|---|
| Available Memory Space in Bytes | About 116000 | About 116000 | About 116000 for FW version 1.07 or lower<br>About 147000 for FW version 1.08 or higher |
| Memory Requirement for Message in Bytes | 24 x 500 = 1200 | 32 x 500 = 16000 | 32 x 500 = 16000 |
| Remaining Memory Capacity in Bytes | 104000 | 100000 | About 100000 for FW version 1.07 or lower<br>About 1294000 for FW version 1.08 or higher |
| Possible Number of Data Sets | 104000 / (22+33) = 1890 | 100000 / (22+39) = 1639 | 100000 / (22+44) = 1515 for FW version 1.07 or lower<br>1294000 / (22+44) = 1960 for FW version 1.08 or higher |

You can use the following formula to determine the exact message buffer size:

G >= M1 + M3 + 20

G = Size of message buffer

B = Size of parallel message system in bytes

M1 = Number of messages which: require only 1 memory location, are

entered in the message editor and have message numbers smaller than B x 8

M3 = Number of messages which: require 3 memory locations, are entered in the message editor and have message numbers smaller than B x 8

20 = Minimum size of message buffer

## 3.25 Application ID

You can use the application ID to identify any application.

The application ID is stored in the project's S3 file and is therefore stored in the operating device after the download. The same ID is stored in the project management file.

You can compare the IDs of a project management file with that of an S3 file.

You can also compare the IDs of an S3 file and operating device content. To do this, you must establish a connection between the PC and the operating device (download cable).

The application ID is made up of the following elements:

- ID text
- Version
- Date
- Time
- Counter
- Postfix

**ID Text** The ID text has up to 13 characters. This means that the file name of the project can be entered in 8.3 format. You can edit the ID text as required.

**Version** The version of the programming software has up to 5 characters. This text cannot be changed.

**Date** The creation date has six characters. This text cannot be changed.

**Time** The time of the translation of the project is provided using six characters. This text cannot be changed.

**Counter** The counter has four characters and specifies the number of translation runs. This text cannot be changed.

**Postfix** The postfix is a random number made up of two characters. This number cannot be changed.

## 3.26 Version Number

You can use the version number to store any value in the operating device.

The valid range of values is 0 to 255.

The value is saved in the system variable **UserVersion**.

You can output this system variable in any input/output mask.

There is no other functional link in the operating device. You cannot change the value in the operating device.

See chapter “UserVersion“ on page 3-42.

## 3.27 Image of Mask Number

You can have the number of the current mask of the operating device written to a controller variable. The controller variable must be a 16-bit variable.

For each mask change, the operating device writes the current mask number in this variable. The mask number represents a mask-specific code.

This means that you can access the user interface from the controller.

## 3.28 Image of User Mode Switch

In standard mode, the image of the user mode switch is transferred to the controller after the initialization phase is complete. You can choose to have any unassigned DIP-switches evaluated by the controller. This allows you to call up specific programs or to create queries in a service routine.

## 3.29 Parallel Outputs

You can address the parallel outputs of the operating device from the controller. To be able to operate the parallel outputs from the controller, you must define a variable for the control word. The word must be divided into two single bytes if the controller is only capable of accessing in byte mode. The byte order depends on the type of controller being used.

Table 3-53 Structure of the control word for the parallel outputs

| **Bit Number** | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **15** | **14** | **13** | **12** | **11** | **10** | **9** | **8** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
| A1 | | A2 | | A3 | | A4 | | A5 | | A6 | | A7 | | A8 | |
| On/Off | Flashing | On/Off | Flashing | On/Off | Flashing | On/Off | Flashing | On/Off | Flashing | On/Off | Flashing | On/Off | Flashing | On/Off | Flashing |

The structure of the control word illustrates that one bit pair always controls one output. The following truth table applies to every bit pair:

Table 3-54 Truth table for a parallel output

| **Bit 1** | **Bit 2** | **Output Status** |
|---|---|---|
| 0 | 0 | OFF |
| 0 | 1 | OFF, FLASHING is preset |
| 1 | 0 | ON |
| 1 | 1 | FLASHING |

In addition to the variable name, the polling time must be specified in the system parameters to determine the cyclical intervals at which the control word is to be polled.

## 3.30 Screen Saver

Some operating devices are fitted with a screen saver. This function monitors all outputs to the display. If the system detects that nothing is being output to the display, a timeout begins to elapse. After the timeout has elapsed, the display is blanked and the status LED in the Help key begins to flash. The display can be reactivated by pressing any key. Activation of the screen saver can be made dependent on the display of cyclical variables.

The monitoring time can be defined in 0.1 second steps. If you enter the value 0 for the time, the screen saver remains deactivated.

## 3.31 Documentation

You can document the entire content of a project in an RTF file. To determine the scope of documentation, select the required project elements that are arranged in a tree structure.

You can fine-tune the documentation layout by selecting and deselecting different documentation parameters.

### 3.31.1 Documentation Parameters

You can use the documentation parameters to influence the layout of the documentation to be generated for the selected elements of a project.

#### 3.31.1.1 Global Settings

Select whether you would like the mask reference lists in the document to be specified by name, or whether the current mask will be specified for a predefined variable value.

If you only specify the mask reference list by name, a reference to the list appears in the documentation. The content of the list is not output.

You can also specify the current mask to which the system will go if the variable value comes up that you enter in the field beside the corresponding selection button.

A page feed can be inserted after each documentation element to improve presentation.

#### 3.31.1.2 Projects

You can select whether the documentation will take account of all elements entered in the general project information.

#### 3.31.1.3 Masks

You can have the position of variables created in a mask documented either in pixels or grid units. The grid unit is based on the font NORMAL.

If necessary, you can display the variables of a mask with sequential numbers. The system then specifies the variable's sequential number in the left position of the variable frame.

You can also activate the description of a mask’s variable.

Variables for which you have not specified a documentation value are displayed as an empty frame, if necessary.

For variables of the type Selection Text, you can output the entries of the

linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a mask that are under a specific number of entries.

If necessary, you can have documentation written for the functions of the function keys in a mask.

### 3.31.1.4 Recipes

You can have the position of recipe elements documented either in pixels or grid units. The grid unit is based on the font NORMAL.

If necessary, you can display the variables of a recipe with sequential numbers. The system then specifies the variable's sequential number in the left position of the variable frame.

You can also activate the description of a recipe’s variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a recipe that are under a specific number of entries.

In addition, you can specify whether the values of the recipe data sets are to be documented as well.

### 3.31.1.5 Help Masks

You can have the position of variables created in a help mask documented either in pixels or grid units. The grid unit is based on the font NORMAL.

If necessary, you can display the variables of a help mask with sequential numbers. The system then specifies the variable's sequential number in the left position of the variable frame.

You can also activate the description of a help mask’s variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a help mask that are under a specific number of entries.

### 3.31.1.6 System Messages

You can have the position of variables created in a system message documented either in pixels or grid units. The grid unit is based on the font NORMAL.

You can also activate the description of a system message's variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a help mask that are under a specific number of entries.

### 3.31.1.7 Messages

You can have the position of variables created in a message documented either in pixels or grid units. The grid unit is based on the font NORMAL.

You can also activate the description of a message's variable.

For variables of the type Selection Text, you can output the entries of the linked text list, if necessary.

The number specified for the maximum number of text list entries must exceed the actual number of text list entries, to ensure that the texts are listed. This will ensure the selective documentation of all text lists in a message that are under a specific number of entries.

## 3.32 Downloading a Project

The Download function describes how you can load a new project into the Flash memory of the operating device. To do this, you must connect the operating device with the PC and set it to the download operating mode.

To do this:

– In a mask, enter the value 1 in the system variable **IntEraseEprom** OR
– Switch off the supply voltage, set the user mode switch S4 to ON, switch on the device again, and - after the system message appears - switch the user mode switch S4 to OFF again under operating voltage.

If, instead of a Flash memory, the operating device contains a UV-erasable EPROM, the system recognizes this and prevents a deletion or programming process.

The following error message is displayed:

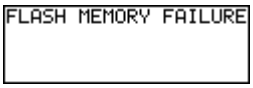



Figure 3-29 Error message FLASH MEMORY FAILURE

This error message indicates that a write process was not completed successfully.

During programming, we recommend that you activate the automatic download function. By starting the download on the PC, you automatically set the operating device to the download operating mode.

If you are using a PC without a serial interface (for example, a laptop) you can perform the download using an adapter via the USB interface. For a suitable USB adapter (part number 81 215.000) contact Sütron electronic GmbH.

### 3.32.1 Automatic Download Function

You activate the automatic download function in the project's system parameters. Before you can use the function, you must (one time) load the project conventionally to the operating device using the automatic download function.

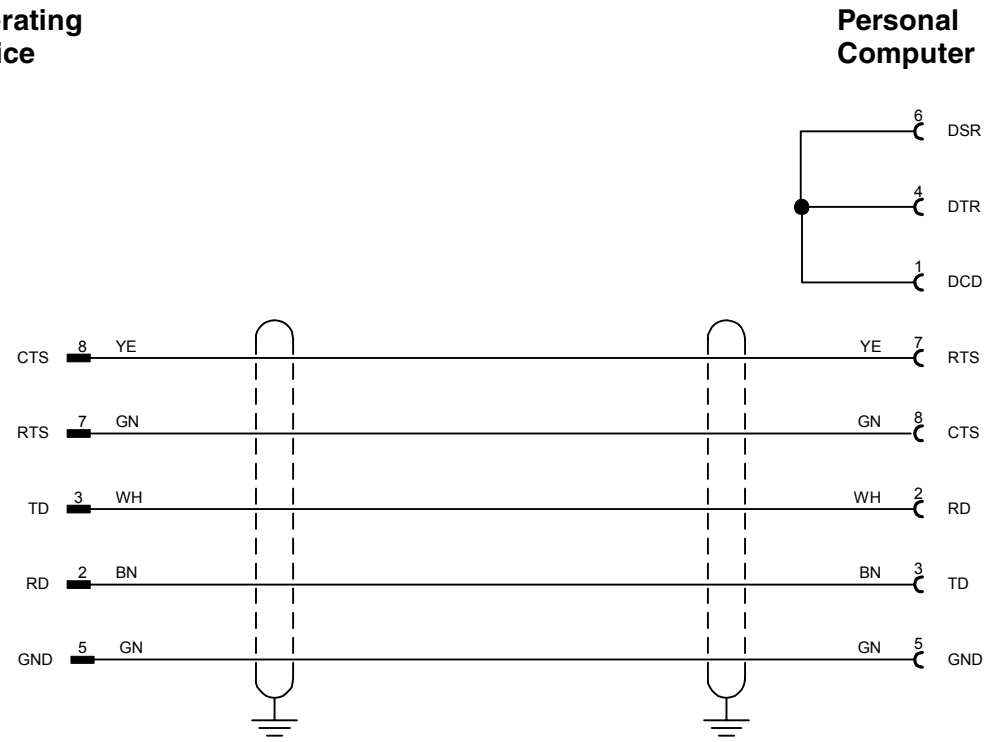
You can force each subsequent download when the operating device is running, by starting the download on the PC.

If you do this, the following data is lost in the operating device:

– Message data from the message memory
– All RAM data sets that were not saved
– All system parameters that were changed online (values of system variables, interfaces, passwords).

## 3.32.2 Download Cable 9 Pin

This download cable does **not** apply to operating devices with a universal interface.




D-SUB
male connector
9 pin

D-SUB
female connector
9 pin

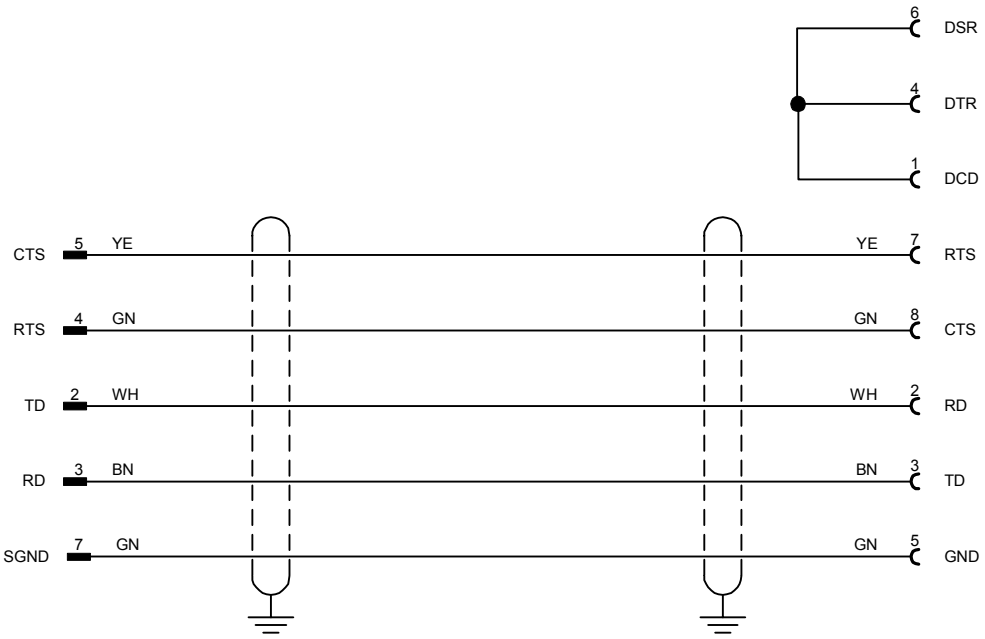
Both ends of the shield are connected to the metallic housing of the connector.

## 3.32.3 Download Cable 25 Pin

This download cable applies to operating devices with a universal interface **only**.

**Operating device**

**Personal Computer**




D-SUB
male connector
25 pin

D-SUB
female connector
9 pin

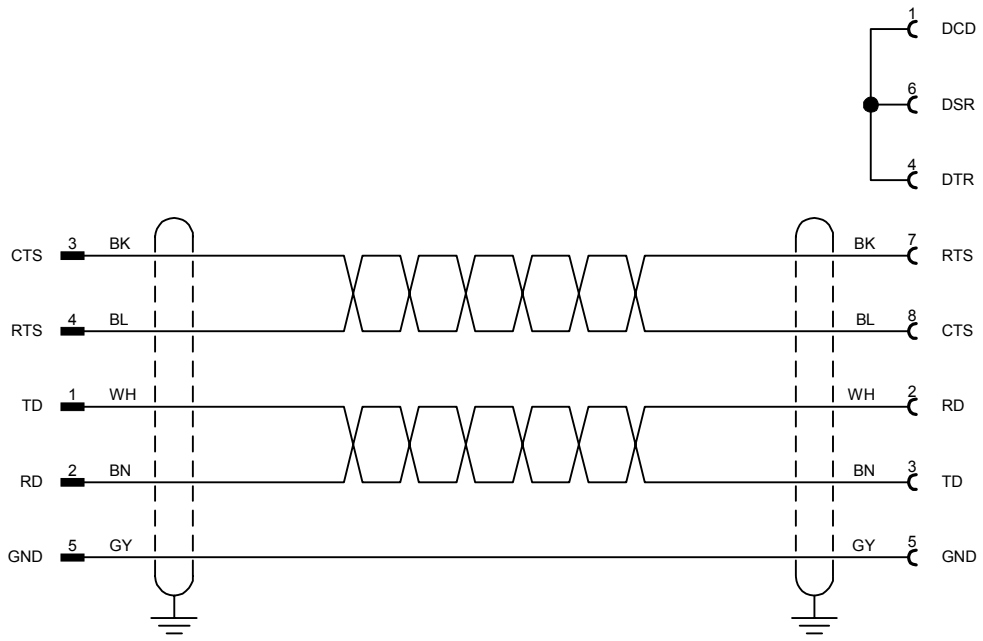
Both ends of the shield are connected to the metallic housing of the connector.

## 3.32.4 Download Cable for Hand-Held Operating Devices

This download cable applies to hand-held operating devices **only**.

**Operating device**

**Personal Computer**




Binder series 702
Male connector
5 pin

D-SUB
female connector
9 pin

Both ends of the shield are connected to the metallic housing of the connector.

## 3.33 Simulation Without a Controller (Demo Mode)

You can test the entire user interface for a project on the operating device without having a controller connected. Although this simulation permits the entry of variable values, the values are not transferred. As a result, you can test the range limits when values are being entered. You can also call help information for variables and masks, and test mask changes.

No communication occurs even if you connect a controller.

See chapter “Setting the Operating Mode“ on page 3-1.

# 4 Transparent Mode

Transparent mode is the name of an operating mode in which the operating device only functions as a text display unit with a printer connection. The controller must provide the operating device with all characters and control sequences required to display the data and values. A message (system message) is only displayed by the operating device in the event of major errors. All parameters required for communication with the controller are set in the setup mask.

Transparent mode is not supported by operating devices with touch-screens.

## 4.1 Setting the Operating Mode

Make sure you switch the device off before setting the operating mode. Otherwise the device will not accept the new operating mode setting.

Note the switch positions ON and OFF marked on the user mode switch. Depending on the type of user mode switch, the position of the switches may vary.

All operating devices are factory-set to the Standard Mode of operation. The operating mode is set with the user mode switch.

Refer to the device-specific user manual for more information on where the user mode switch is located on the device.

After you switch on the power supply, the switch position is read and evaluated once (during the initialization phase).

To set the user mode switch with four switches to the operating mode **Transparent Mode**:

Table 4-1 User mode switch with four switches - Transparent Mode

| Switch | Position |
|---|---|
| 1 | OFF |
| 2 | Free |
| 3 | OFF |
| 4 | OFF |

To set the user mode switch with eight switches to the operating mode **Transparent Mode**:

Table 4-2 User mode switch with four switches - Transparent Mode

| Switch | Position |
|---|---|
| 1 | OFF |
| 2 | Free |
| 3 | OFF |
| 4 | OFF |
| 5 | Free |
| 6 | Free |
| 7 | Free |
| 8 | Free |

## 4.2 Behavior of the Operating Device During Start-Up

All of the operating devices function in exactly the same way. When the voltage supply is connected, the request "PRESS ENTER TO RUN SETUP“ is displayed.

Data is displayed as a single center-justified line, or as two lines in smaller displays. All of the LEDs are activated while the message appears. You can thus check that all of the status LEDs are functioning properly. The display time is 2 seconds. After this time, the message disappears, the cursor in the display is positioned in the top left-hand corner (X=1, Y=1) and the characters received for interface X2 are interpreted and displayed.

If you press the **Enter** key soon after activation while the message is displayed, the setup mask appears on the display with all of the adjustable, device-specific parameters. Once you have selected the Data Release key, you can adjust the interface parameters (the status LED for the data release lights up). Since you can only select from predefined parameter values, no incorrect entries can be selected. To complete data entry, press the **Data Release** key again (the status LED for the data release goes out). If you now press the **Enter** key, the operating device restarts with the valid parameters.

If you press the **Enter** key before the prompt PRESS ENTER TO RUN SETUP is displayed, the error message KEYBOARD ERROR PLEASE RELEASE KEY will appear.

A self-test is performed and the keyboard is checked when the operating device is switched on. Make sure no keys are pressed during this process. Please follow the request to release the key. If this error message is issued when no key is pressed, it indicates that the keyboard is defective!

## 4.3 Communication in Transparent Mode

Communication takes place in transparent mode via the interface X2 or X3 SER1 only.

You must connect the controller or the higher-level computer to this interface. You must adapt the transfer parameters in the setup mask in line with the requirements.

## 4.4 Parameters for Interface X2, X3 SER1

If no changes are made, the following default settings are used for the interfaces:

Table 4-3 Interface parameters

| Parameter | X2 (X2.1) | X3 SER1 |
|---|---|---|
| Baud Rate | 19200 Baud | 9600 Baud |
| Data Bits | 8 | 7 |
| Stop Bits | 1 | 1 |
| Parity | None | Odd |
| Handshake | Xon/Xoff | Xon/Xoff |

The default settings are stored in the Flash memory and can not be lost.

### 4.4.1 Receive Buffer for Interface X2

The receive buffer for interface X2 has a size of 256 bytes.

### 4.4.2 Setup Menu Function

In the Setup menu you can set the following parameters:

– interface X2
– interface X3 SER1
– Date
– Time
– Default contrast/brightness depending on the display

In addition, the version number of the operating system is displayed in the header line.

### 4.4.3 Changing the Parameters in the Setup Menu

Within the setup mask, an editor allows you to change the parameters. You can switch to the editor by pressing the Data Release key. You can change the data as soon as the status LED for the data release lights up. Change the values of the variables using the Plus/Minus keys or the numerical keys. You must confirm your entry with the Enter key. If possible with the character attributes of the display, changed data is displayed inversely. To avoid making incorrect changes or entries, you must enter the values in a predefined sequence which must always be followed.

**Example of a correct change:**

1. After start-up, press the Enter key when the prompt appears.

The Setup menu now appears on the display. You must select this step, even if you only want to view the parameters.

2. If you have made no changes, you can quit the menu by hitting the Enter key again.

When you press the Data Release key, the status LED for the data release lights up and indicates that the editing mode is in transparent mode.

The cursor flashes on the first variable that can be edited.

3. Use the cursor keys to select the variable required.
4. You can enter numerical values using the number keyboard, while texts can be selected using the Plus/Minus keys.
5. You must confirm each entry with the Enter key.

Once an entry is correctly made, the cursor moves to the next entry field that can be edited.

For the interface parameters, the variable for confirming the changes must be set to SETUP DATA. This prevents any unauthorized entries. You must select SETUP DATA separately for the interfaces of connectors X2 and X3.

6. To quit editing mode, press the Data Release key again. The LED goes out and the adjusted values are displayed inversely.

You can implement new corrections using the Data Release key.

7. To quit the Setup menu, press the Enter key.

The operating device is rebooted and the parameters set are applied. You can repeat the entire procedure if you wish, without having to switch off the device.

The data are stored in a battery-backed RAM memory. This battery is monitored to prevent any data loss. A message is issued in advance before the battery power becomes too low.

## 4.5 Display

The first cursor position in the display starts at the top left-hand corner (X=1, Y=1). The number of rows and columns allowed depends on the type of device. Refer to the operating device manual for information on possible character attributes.

Table 4-4 Display sizes of the operating devices

| Operating device | Lines | Columns |
|---|---|---|
| BT2 | 4 | 20 |
| BT5 | 4 | 20 |
| BT8 | 4 | 20 |
| BT8 Zoom | 2 | 10 |
| BT10 | 4 | 20 |
| BT14 | 4 | 40 |
| BT15 | 8 | 40 |
| BT15 Zoom | 4 | 20 |
| BT20 | 16 | 40 |
| BT20 Zoom | 8 | 20 |
| BT22 | 20 | 40 |
| BT22 Zoom | 10 | 20 |
| BT25 | 8 | 42 |

Table 4-4 Display sizes of the operating devices

| Operating device | Lines | Columns |
|---|---|---|
| BT25 Zoom | 4 | 21 |
| BT30 | 14 | 42 |
| BT30 Zoom | 7 | 21 |

### 4.5.1 Character Set, Character Attributes

The character set available for display is contained in the user manual for the operating device. Note that if you select the 7-bit character length, it is not possible to address the extended ASCII character set in the range of $128_d$ to $255_d$.

## 4.6 Keys

A start and stop code is sent to the controller each of the activated keys. Refer to the operating device table for the code generated. The characters are transferred in accordance with the interface parameters defined.

### 4.6.1 Key Codes for Each Operating Device

The following tables shows the start and stop codes for all possible operating devices and for all possible keys.

Table 4-5 Key codes for each operating device

| Key | Start Code | Stop Code | BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 48 | 33 | X | X | X | X | X | X | X | X |
| 1 | 49 | 34 | X | X | X | X | X | X | X | X |
| 2 | 50 | 35 | X | X | X | X | X | X | X | X |
| 3 | 51 | 36 | X | X | X | X | X | X | X | X |
| 4 | 52 | 37 | X | X | X | X | X | X | X | X |
| 5 | 53 | 38 | X | X | X | X | X | X | X | X |
| 6 | 54 | 39 | X | X | X | X | X | X | X | X |
| 7 | 55 | 40 | X | X | X | X | X | X | X | X |
| 8 | 56 | 41 | X | X | X | X | X | X | X | X |
| 9 | 57 | 42 | X | X | X | X | X | X | X | X |
| Minus | 111 | 125 | X | X | X | X | X | X | X | X |
| Decimal point | 112 | 126 | X | X | X | X | X | X | X | X |
| Plus | 113 | 124 | X | X | X | X | X | X | X | X |
| Data Release | 108 | 122 | X | X | X | X | X | X | X | X |
| Enter | 109 | 121 | X | X | X | X | X | X | X | X |

Table 4-5 Key codes for each operating device

| Key | Start Code | Stop Code | BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 |
|---|---|---|---|---|---|---|---|---|---|---|
| Delete | 110 | 123 | X | X | X | X | X | X | X | X |
| Help | 106 | 107 | X | X | X | X | X | X | X | X |
| Cursor Up | 101 | 118 | X | X | X | X | X | X | X | X |
| Cursor Down | 102 | 119 | X | X | X | X | X | X | X | X |
| Cursor Left | 103 | 116 | X | X | X | X | X | X | X | X |
| Cursor Right | 104 | 117 | X | X | X | X | X | X | X | X |
| Cursor Home | 105 | 120 | X | X | X | X | X | X | X | X |
| F1 | 65 | 66 | X | X | X | X | X | X | X | X |
| F2 | 67 | 68 | X | X | X | X | X | X | X | X |
| F3 | 69 | 70 | X | X | X | X | X | X | X | X |
| F4 | 71 | 72 | X | X | X | X | X | X | X | X |
| F5 | 73 | 74 | X | X | X | X | X | X | X | X |
| F6 | 75 | 76 | X | X | X | X | X | X | X | X |
| F7 | 77 | 78 | | X | X | X | X | X | X | X |
| F8 | 79 | 80 | | X | X | X | X | X | X | X |
| F9 | 81 | 82 | | | X | X | X | X | X | X |
| F10 | 83 | 84 | | | X | X | X | X | X | X |
| F11 | 85 | 86 | | | X | X | X | X | X | X |
| F12 | 87 | 88 | | | X | X | X | X | X | X |
| F13 | 89 | 90 | | | X | X | | X | X | X |
| F14 | 91 | 92 | | | X | X | | X | X | X |
| F15 | 93 | 94 | | | X | X | | X | X | X |
| F16 | 95 | 96 | | | X | X | | X | X | X |
| F17 | 97 | 98 | | | | | | X | X | X |
| F18 | 99 | 100 | | | | | | X | X | X |
| F19 | 144 | 145 | | | | | | X | X | |
| F20 | 146 | 147 | | | | | | X | X | |
| Print | 77 | 78 | X | | | X | | X | | |
| Page Down | 79 | 80 | X | | | X | | X | | |
| Page Up | | | | | | X | | X | | |
| Acknowledge | | | | | | X | | X | | |
| S1 | 128 | 129 | | | X | | | X | | |
| S2 | 130 | 131 | | | X | | | X | | |
| S3 | 132 | 133 | | | X | | | X | | |

Table 4-5 Key codes for each operating device

| Key | Start Code | Stop Code | BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 |
|---|---|---|---|---|---|---|---|---|---|---|
| S4 | 134 | 135 | | | X | | | X | | |
| S5 | 136 | 137 | | | X | | | X | | |
| S6 | 138 | 139 | | | X | | | X | | |
| S7 | 140 | 141 | | | X | | | X | | |
| S8 | 142 | 143 | | | X | | | X | | |

## 4.7 Control Characters for the Interface

Control characters are interpreted by the operating device and can not be displayed on the screen.

Table 4-6 Non-displayable control characters

| Character | Abbreviation | Code | Function |
|---|---|---|---|
| Backspace | BS | 8 | Cursor is moved one column to the left. |
| Linefeed | LF | 10 | Cursor is moved down one line. |
| Return | CR | 13 | Cursor is moved to the beginning of the line. |
| Xon | XON | 17 | Ready signal during software handshake. |
| Xoff | XOFF | 19 | Not ready until next XON. |
| Escape | ESC | 27 | Start character for all control sequences. |
| Delete | DEL | 127 | Deletes the character at the cursor position. |

### 4.7.1 LED Codes for the Operating Devices

Table 4-7 Codes for the status LEDs in the keys

| Key | Code (dec) | BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 |
|---|---|---|---|---|---|---|---|---|---|
| Data Release | 20 | X | X | X | X | X | X | X | X |
| Help | 19 | X | X | X | X | X | X | X | X |
| F1 | 1 | X | X | X | X | X | X | X | X |
| F2 | 2 | X | X | X | X | X | X | X | X |
| F3 | 3 | X | X | X | X | X | X | X | X |
| F4 | 4 | X | X | X | X | X | X | X | X |
| F5 | 5 | X | X | X | X | X | X | X | X |
| F6 | 6 | X | X | X | X | X | X | X | X |
| F7 | 7 | - | X | X | X | X | X | X | X |
| F8 | 8 | - | X | X | X | X | X | X | X |
| F9 | 9 | - | X | X | X | X | X | X | X |
| F10 | 10 | - | - | X | X | X | X | X | X |
| F11 | 11 | - | - | X | X | X | X | X | X |
| F12 | 12 | - | - | X | X | - | X | X | X |
| F13 | 13 | - | - | X | X | - | X | X | X |
| F14 | 14 | - | - | X | X | - | X | X | X |
| F15 | 15 | - | - | X | X | - | X | X | X |
| F16 | 16 | - | - | X | X | - | X | X | X |
| F17 | 17 | - | - | - | - | - | X | X | X |
| F18 | 18 | - | - | - | - | - | X | X | X |
| F19 | 33 | - | - | - | - | - | X | X | - |
| F20 | 34 | - | - | - | - | - | X | X | - |
| Add. LED 1 | 29 | - | - | X | - | - | - | X | - |
| Add. LED 2 | 30 | - | - | X | - | - | - | X | - |
| Add. LED 3 | 31 | - | - | X | - | - | - | X | - |
| Add. LED 4 | 32 | - | - | X | - | - | - | X | - |
| LED Cursor Up | 21 | - | - | X | - | - | - | - | - |
| LED Cursor Down | 22 | - | - | X | - | - | - | - | - |
| LED Cursor Left | 23 | - | - | X | - | - | - | - | - |
| LED Cursor Right | 24 | - | - | X | - | - | - | - | - |
| S1 (special model) | 25 | - | - | X | - | - | - | - | - |

Table 4-7 Codes for the status LEDs in the keys

| Key | Code (dec) | BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 |
|---|---|---|---|---|---|---|---|---|---|
| S2 (special model) | 26 | - | - | X | - | - | - | - | - |
| S3 (special model) | 27 | - | - | X | - | - | - | - | - |
| S4 (special model) | 28 | - | - | X | - | - | - | - | - |

## 4.7.2 Control Sequences for Operating Devices

Table 4-8 Nomenclature for the control sequences

| Sequence | Description |
|---|---|
| <ESC> | Represents the ESC character. |
| <A> | Represents the line number. |
| <B> | Represents the column number. |
| <A> and <B> | Represent a decimal number specified as one or more ASCII characters. The limits are determined by the display size. |
| <An> | Represents a decimal number that selects a subfunction. Multiple subfunctions must be separated by semicolons. |
| <Pn> | Represents a numeric parameter. Specifies a decimal number. |

Table 4-9 Control sequences

| BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 | Sequence | Function |
|---|---|---|---|---|---|---|---|---|---|
| X | X | X | X | X | X | X | X | <ESC>[2J | Clears the screen and moves the cursor to line 1, column 1. |
| X | X | X | X | X | X | X | X | <ESC>[K | Erase Line: Clears all characters to the right of the cursor position up to theend of the line (including the character at the cursor position). |
| X | X | X | X | X | X | X | X | <ESC>[<A>;<B>h | Position text in line A of column B. A, B limited by display. |
| X | X | X | X | X | X | X | X | <ESC>[<A>;<B>H | Position cursor in line A of column B. A, B limited by display. |
| X | X | X | X | X | X | X | X | <ESC>[<Pn>A | Cursor up: Moves the cursor up the specified number of lines without changing columns. The command is ignored if the cursor is already on the top line. |
| X | X | X | X | X | X | X | X | <ESC>[<Pn>B | Cursor down: Moves the cursor down the specified number of lines without changing columns. The command is ignored if the cursor is already on the bottom line. |

Table 4-9 Control sequences

| BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 | Sequence | Function |
|---|---|---|---|---|---|---|---|---|---|
| X | X | X | X | X | X | X | X | <ESC>[<Pn>C | Cursor right: Moves the cursor to the right the specified number of columns without changing the line. The command is ignored if the cursor is already in the rightmost column. |
| X | X | X | X | X | X | X | X | <ESC>[<Pn>D | Cursor left: Moves the cursor to the left the specified number of columns without changing the line. The command is ignored if the cursor is already in the leftmost column. |
| X | X | X | X | X | X | X | X | <ESC>&C | Display cursor. |
| X | X | X | X | X | X | X | X | <ESC>&D | Deactivate cursor. |
| X | X | X | X | X | X | X | X | <ESC>[s | Saves the cursor position: You can movethe cursor back to the saved cursor position by using another ESC sequence. |
| X | X | X | X | X | X | X | X | <ESC>[u | Restore cursor position: Returns the cursor to the stored position. |
| - | - | - | X | X | X | X | X | <ESC>&Z | Display characters using large characters (zoom font). |
| - | - | - | X | X | X | X | X | <ESC>&A | Display characters in normal size. |
| X | X | X | X | X | X | X | X | <ESC>[<A1>;<An> m | Set character attributes. A1 to An is the attribute number. |
| X | X | X | X | X | X | X | X | 0 = all attributes off | |
| - | - | - | X | X | X | X | X | 4 = underline | |
| X | X | X | X | X | X | X | X | 5 = flashing | |
| - | - | - | X | X | X | X | X | 7 = inverse | |
| X | X | X | X | X | X | X | X | <ESC>[<A1>;<An> q | Switch LED on. A1 to An is the number of the LED.<br>A = 0 switch on all LEDs. |
| X | X | X | X | X | X | X | X | <ESC>&q<A1>;<An>: | Flashing LEDs. A1 to An is the number of the LED.<br>A = 0 flashing on for all LEDs. |
| X | X | X | X | X | X | X | X | <ESC>&p<A1>;<An>: | Switch LEDs off. A1 to An is the number of the LED.<br>A = 0 switch off all LEDs. |
| X | X | X | X | X | X | X | X | <ESC>[6n | Query by controller to see which operating terminal is connected. The operating terminal responds with: |
| X | - | - | - | - | - | - | - | Reply <ESC>[05 | |
| - | - | X | - | - | - | - | - | Reply <ESC>[14 | |
| - | - | - | X | - | - | - | - | Reply <ESC>[15 | |
| - | - | - | - | X | - | - | - | Reply <ESC>[22 | |

Table 4-9 Control sequences

| BT5 | BT10 | BT14 | BT15 | BT20 | BT22 | BT25 | BT30 | Sequence | Function |
|---|---|---|---|---|---|---|---|---|---|
| - | - | - | - | - | X | - | - | Reply <ESC>[20 | |
| - | - | - | - | - | - | X | - | Reply <ESC>[25 | |
| - | - | - | - | - | - | - | X | Reply <ESC>[30 | |
| X | X | X | X | X | X | X | X | <ESC>&t | Display the time at the cursor position. Format hh:mm:ss |
| X | X | X | X | X | X | X | X | <ESC>&d | Display the date at the cursor position Format DD.MM.YY |
| X | X | X | X | X | X | X | X | <ESC>&JJMMTTh-hmmssi | Set date/time.<br>JJ = year<br>MM = month<br>TT = day<br>hh = hour<br>mm = minutes<br>ss = seconds |
| X | X | X | X | X | X | X | X | <ESC>&u | Send the time to interface X2. The date and time are returned in a format that is identical to the set format.<br>Reply: <ESC>&JJMMTThhmmssi |
| X | X | X | X | X | X | X | X | <ESC>[<A>;<B>U | Start to output the time in line A and column B at cyclic intervals. The current character attributes are used when displaying the time. |
| X | X | X | X | X | X | X | X | <ESC>[0;0U | Stop cyclic display of the time. |
| X | X | X | X | X | X | X | - | <ESC>&K | Default contrast setting for the display. |
| X | X | X | X | X | X | X | - | <ESC>&+ | Increments the specified value by +1. The contrast becomes brighter. The maximum value range is ±125. However, the value range is limited to values appropriate for the corresponding display. |
| X | X | X | X | X | X | X | - | <ESC>&- | Decrements the specified contrast value by -1. The contrast becomes darker. |

## 4.8 Error Messages

Error messages generated by the operating device are usually displayed in the top left-hand corner of the display (X=1, Y=1). These error messages appear as plain text. The error messages are displayed just once and the previous text is overwritten! The message is not deleted but must be overwritten by the user. This fact must be taken into account when the program is created. The following internal error texts may appear:

**LOW BAT**

This indicates that the battery power is too low to retain data. You must replace the battery within 3 days of this message first appearing! The battery is monitored when the device is activated and then every 60 minutes.

**FRAMING ERROR**

On the interface, characters were received with a data format that does not correspond to the interface parameters defined. Check the number of data bits, stop bits and the parity bit.

**PARITY ERROR**

On the interface, characters containing a parity error were received. This may be due to problems with the transmission cable (character length, baud rate, transmission fault, incorrect interface parameters etc.)

**OVERRUN ERROR**

The operating device was unable to interpret and evaluate the characters received on the interface. This might be due to errors during handshake operation between the operating device and the controller. Check the hardware or software handshake procedure.

**TRANSMIT ERROR**

The operating device was unable to transmit characters within the predefined timeout period (no handshake release). This might be due to errors during handshake operation between the operating device and the controller. Check the hardware or software handshake procedure.

**KEYBOARD ERROR PLEASE RELEASE KEY**

An internal test of the keyboard is carried out when the operating device is switched on. Make sure no keys are pressed during this process. Please follow the request. If this message is issued when no key is pressed, it indicates that the keyboard is defective!

# 5 Controller and Bus Connections

For more information on the individual connections possible for TesiMod operating devices in the standard or bus models, see the following chapters. The same 25 pin D-SUB connector is used for all operating devices of the standard model with a universal interface. For devices built prior to the n-series and for bus model operating devices, different connectors are used for the connection.

# 5.1 3964 RK512

The 3964/RK512 protocol allows you

– direct read-access to all PLC data
– indirect write-access to all PLC data if the supplied function block is used
– direct write-access to all data in a data block
– bit-access to all byte-oriented data types
– byte access to all data words in a data block.

## 5.1.1 Procedure of the 3964 Protocol

### 5.1.1.1 Telegram for Connection Setup

The connection setup is initiated by the active partner. If the connection cannot be established successfully (passive partner sends NAK), the active partner will repeat the attempt 3 times.

If the connection setup is successful, but the passive partner transmits a NAK after receiving the data block, the active partner will make up to 6 attempts to establish the connection and to transmit the data.

Table 5-1 Connection set-up telegram for the 3964 procedure

| Active Partner (Operating Device) | Data | Passive Partner |
|---|---|---|
| Sending | STX | Receiving |
| Receiving | DLE (NAK) | Sending |
| Sending | Data | Receiving |
| Sending | DLE | Receiving |
| Sending | ETX | Receiving |
| Sending | BCC (optional) | Receiving |
| Receiving | DLE (NAK) | Sending |

The block check must be activated if the BCC (block check character) is to be added to the transmission.

### 5.1.1.2 Data Request Telegram

Table 5-2 Data Request telegram for the 3964 procedure

| Active Partner (Operating Device) | Data | Passive Partner |
|---|---|---|
| Sending | STX | Receiving |
| Receiving | DLE | Sending |
| Sending | Telegram Header | Receiving |
| Sending | DLE | Receiving |
| Sending | ETX | Receiving |
| Sending | BCC (optional) | Receiving |

Table 5-2 Data Request telegram for the 3964 procedure

| Active Partner (Operating Device) | Data | Passive Partner |
|---|---|---|
| Receiving | DLE | Sending |
| Receiving | STX | Sending |
| Sending | DLE | Receiving |
| Receiving | Response Telegram | Sending |
| Receiving | Data | Sending |
| Receiving | DLE | Sending |
| Receiving | ETX | Sending |
| Receiving | BCC | Sending |
| Sending | DLE | Receiving |

#### 5.1.1.3 Data Request Telegram Header

Table 5-3 Data Request Telegram header for the 3964 procedure

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 1 | Telegram ID | | 00 | Value is always 00 |
| 2 | | | | |
| 3 | Data direction | E | 45 | E = Request |
| 4 | Command | | | See chapter “Specification of the Data Types in the "Data Request" Telegram Header“ on page 5-5. |
| 5 | Source | | | See chapter “Specification of the Data Types in the "Data Request" Telegram Header“ on page 5-5. |
| 6 | | | | |
| 7 | Number | | | See chapter “Specification of the Data Types in the "Data Request" Telegram Header“ on page 5-5. |
| 8 | | | | |
| 9 | Coordination Flag No. | | | FF = Without Coordination Flag |
| 10 | Coordination Flag Bit | | | xF = Without Coordination Flag |

If you enter the value FFH for the coordination flag number and the value FH for the coordination flag bit into the protocol parameters, the monitoring function is deactivated.

#### 5.1.1.3.1 Specification of the Data Types in the "Data Request" Telegram Header

The operating device can access all of the data types of the controller. The data types are decoded in the telegram header as follows.

Table 5-4 Specification of the data types in the "Data Request" telegram header

| Data Type | Mnemonics | Byte 4 (Command) | Byte 5 | Byte 6 | Byte 7 + 8 (Number) |
|---|---|---|---|---|---|
| Input Bit | E | E | Offset | Bit No. | 1 Byte |
| Input Byte | EB | E | Offset | | n Bytes |
| Input Word | EW | E | Offset | | n Bytes |
| Input Double-Word | ED | E | Offset | | n Bytes |
| Output Bit | A | A | Offset | Bit No. | 1 Byte |
| Output Byte | AB | A | Offset | | n Bytes |
| Output Word | AW | A | Offset | | n Bytes |
| Output Double-Word | AD | A | Offset | | n Bytes |
| Flag Bit | M | M | Offset | Bit No. | 1 Byte |
| Flag Byte | MB | M | Offset | | n Bytes |
| Flag Word | MW | M | Offset | | n Bytes |
| Flag Double-Word | MD | M | Offset | | n Bytes |
| Data Word | DW | D | DB | DW | n Words |
| Data Word Left (High) | DL | D | DB | DW | 1 Word |
| Data Word Right (Low) | DR | D | DB | DW | 1 Word |
| Data Double-Word | DD | D | DB | DW | n Words |
| Timer | T | T | Offset | | n Words |
| Counter | Z | Z | Offset | | n Words |

If you specified a coordination flag in the protocol parameters, this flag is set in the passive partner upon receipt of data. After processing the received data, the coordination flag is reset.

If the passive partner's coordination flag is set when it receives data, then the passive partner sends a response telegram to the active partner thereby indicating this as an error.

For connections to a Simatic S5 with a CP524/525 communication module, the coordination flag must be entered into DB1 as an output communication flag.

#### 5.1.1.4 Response Telegram

Table 5-5 Response telegram for the 3964 procedure

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 1 | Telegram ID | | 00 | Value is always 00 |
| 2 | | | | |
| 3 | | | | Value is always 00 |
| 4 | Error Code | | xx | |

#### 5.1.1.5 Data Transmission Telegram

Table 5-6 Data transmission telegram for the 3964 procedure

| Active Partner (Operating Device) | Data | Passive Partner |
|---|---|---|
| Sending | STX | Receiving |
| Receiving | DLE | Sending |
| Sending | Telegram Header | Receiving |
| Sending | DLE | Receiving |
| Sending | ETX | Receiving |
| Sending | BCC (optional) | Receiving |
| Receiving | DLE | Sending |
| Receiving | STX | Sending |
| Sending | DLE | Receiving |
| Receiving | Response Telegram | Sending |
| Receiving | DLE | Sending |
| Receiving | ETX | Sending |
| Receiving | BCC | Sending |
| Sending | DLE | Receiving |

#### 5.1.1.6 Data Transmission Telegram Header

The "Data Transmission" telegram header of the 3964 procedure has a size of 10 bytes.

When transmitting data, the destination is always a data block.

Table 5-7 Data transmission telegram header for the 3964 procedure

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 1 | Telegram ID | | 00 | Value is always 00 |
| 2 | | | | |
| 3 | Data direction | A | 41 | A = Transmission |
| 4 | Command | D | 44 | D = Data Block |

Table 5-7 Data transmission telegram header for the 3964 procedure

| Byte No. | Meaning | ASCII | Hex | Comment |
|---|---|---|---|---|
| 5 | Destination | | | Data Block |
| 6 | | | | Data Word |
| 7 | Number | | | Number of Words |
| 8 | | | | |
| 9 | Coordination Flag No. | | | FF = Without Coordination Flag |
| 10 | Coordination Flag Bit | | | xF = Without Coordination Flag |

If you enter the value FFH for the coordination flag number and the value FH for the coordination flag bit into the protocol parameters, the monitoring function is deactivated.

#### 5.1.1.7 Special Features of the 3964R Protocol

A write-access to data is possible in data blocks only. That means, only the data type DW allows a direct write-access to the respective destination.

To make sure you are still able to write-access all of the destinations, write the data into the data block you specified in the protocol parameters.

In this case, you need to add the destination specification (4 bytes) in front of the actual data.

##### 5.1.1.7.1 Destination Information for a Write-Access via a Data Block

The destination information specified within the 4 bytes transmitted before the actual data is decoded as folllows.

Table 5-8 Specifying the destination information for a write-access via a data block

| Data Type | Mnemonics | Byte 1 (Command) | Byte 2 (Number) | Byte 3 | Byte 4 |
|---|---|---|---|---|---|
| Input Bit | E | 10 | 1 Byte | Bit No. | Offset |
| Input Byte | EB | 1 | n Bytes | Offset | |
| Input Word | EW | 1 | n Bytes | Offset | |
| Input Double-Word | ED | 1 | n Bytes | Offset | |
| Output Bit | A | 11 | 1 Byte | Bit No. | Offset |
| Output Byte | AB | 2 | n Bytes | Offset | |
| Output Word | AW | 2 | n Bytes | Offset | |
| Output Double-Word | AD | 2 | n Bytes | Offset | |
| Flag Bit | M | 12 | 1 Byte | Bit No. | Offset |
| Flag Byte | MB | 3 | n Bytes | Offset | |
| Flag Word | MW | 3 | n Bytes | Offset | |
| Flag Double-Word | MD | 3 | n Bytes | Offset | |
| Data-Word Left (High) | DL | 26 | 1 Byte | DB | DW |

Table 5-8 Specifying the destination information for a write-access via a data block

| Data Type | Mnemonics | Byte 1 (Command) | Byte 2 (Number) | Byte 3 | Byte 4 |
|---|---|---|---|---|---|
| Data-Word Right (Low) | DR | 27 | 1 Byte | DB | DW |
| Timer | T | 20 | n Bytes | Offset | |
| Counter | Z | 21 | n Bytes | Offset | |

If you specified a coordination flag in the protocol parameters, this flag is set in the passive partner upon receipt of data. After processing the received data, the coordination flag is reset.

If the passive partner's coordination flag is set when it receives data, then the passive partner sends a response telegram to the active partner thereby indicating this as an error.

#### 5.1.1.7.2 Restrictions of the 3964R Protocol

With the 3964R protocol, a maximum of 128 bytes of data can be transmitted per telegram. No continuation telegrams are transmitted or processed.

### 5.1.2 Data Types

Direct access is possible to the following data types.

The size of each data area depends on the CPU of the PLC.

Table 5-9 3964 RK512 data types

| Type | Mnemonics | Access |
|---|---|---|
| Input Bit | E | Bit Access (Read Access Only) |
| Input Byte | EB | Byte Access (Read Access Only) |
| Input Word | EW | Word Access (Read Access Only) |
| Input Double-Word | ED | Double-Word Access (Read Access Only) |
| Output Bit | A | Bit Access |
| Output Byte | AB | Byte Access |
| Output Word | AW | Word Access |
| Output Double-Word | AD | Double-Word Access |
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Flag Double-Word | MD | Double-Word Access |
| Data Word | DW | Word Access |
| Data-Word Left (High) | DL | Word Access |
| Data-Word Right (Low) | DR | Word Access |

Table 5-9 3964 RK512 data types

| Type | Mnemonics | Access |
|---|---|---|
| Data Double-Word | DD | Double-Word Access |
| Timer | T | Word Access (Read Access Only) |
| Counter | Z | Word Access (Read Access Only) |

**Counter:**

For counters, a distinction is made between variables which have been assigned a counter address and variables which have been assigned another PLC address.

When accessing counter addresses, the count value is interpreted in binary format, the control bits of the counter are masked out.

Therefore, to avoid control bits from being erased, counter addresses should be accessed in **read-mode only**.

The count value is interpreted in BCD-code. This allows the transfer of this value within the PLC program to the counter by means of the accumulator. This function should be used for indirect write-operations of count starting values since the values are available in a Siemens compliant format.

**Timer:**

Timer values consist of a time value and a time base.

The operating device reads the 2-byte variable and converts it into an imaginary unsigned 4-byte variable which represents the time value in reference to the base 0.01 seconds. The operating device makes a distinction between accesses to a timer address and accesses to other controller addresses.

When accessing timer addresses, the operating device interpretes the time value in binary format; when accessing another controller address, the operating device interpretes the time value in BCD code.

Therefore, to avoid the timer's control bits from being erased, timer addresses should be accessed in read-mode only.

Accesses to other addresses should be used for indirect write-operations of timer starting values since the values are prepared in the Siemens compliant format.

Before writing a timer value to the PLC, the operating device converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base. In addition, the operating device makes a distinction between writing the timer value to a timer address and writing it to another PLC address.

## 5.1.3 Programming

### 5.1.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.1.3.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-10 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.1.3.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-11 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.1.3.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-12 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.1.3.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-13 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.1.3.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-14 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.1.3.1.6 Use Coordination Flag

This parameter specifies whether you are using a coordination flag for the communication.

Table 5-15 Use coordination flag

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

#### 5.1.3.1.7 Coordination Flag

This parameter contains the number of the coordination flag you want to use for the communication. Specifying a value of 255 in conjunction with the bit number 15 deactivates the coordination function.

Table 5-16 Coordination flag

| Configurable Values | Default Value |
|---|---|
| 0 to 255 | 0 |

#### 5.1.3.1.8 Bit Number

This parameter specifies the number of the bit in the coordination flag. Specifying a value of 15 in conjunction with the coordination flag number 255 deactivates the coordination function.

Table 5-17 Bit number

| Configurable Values | Default Value |
|---|---|
| 0 to 15 | 0 |

#### 5.1.3.1.9 Data Block Number

This parameter contains the number of the data block to be used for the exchange of controller data.

Table 5-18 Data block number

| Configurable Values | Default Value |
|---|---|
| Any values within the addressing range. | 10 |

#### 5.1.3.1.10 Data Block Word

This parameter specifies the offset of the data within the data block.

Table 5-19 Data block word

| Configurable Values | Default Value |
|---|---|
| Any values within the addressing range. | 0 |

#### 5.1.3.1.11 Floating Point Number in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

Table 5-20 Floating point number in the Siemens format

| Configurable Values | Default Value |
|---|---|
| IEEE Format | |
| Siemens Format | X |

#### 5.1.3.1.12 Block Check

This parameter specifies the block check to be performed for the communication.

Table 5-21 Block check

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

#### 5.1.3.1.13 CPU Number

This parameter specifies the number of the CPU to be used for the communication.

Table 5-22 CPU number

| Configurable Values | Default Value |
|---|---|
| 0 to 15 | 0 |

#### 5.1.3.1.14 Full Duplex

This parameter specifies whether the communication is performed in full duplex mode.

Table 5-23 Full duplex

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

#### 5.1.3.1.15 Half Duplex

This parameter specifies whether the communication is performed in half duplex mode.

Table 5-24 Half duplex

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.1.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

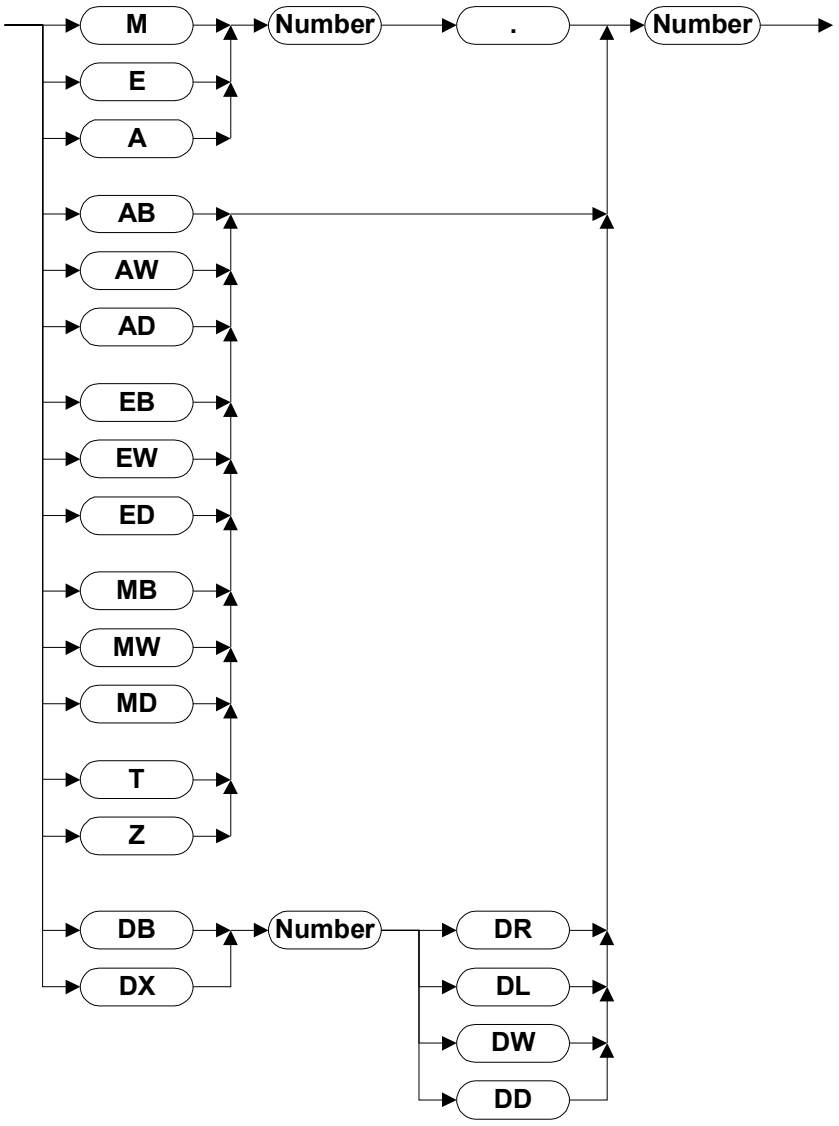



Figure 5-1 Syntax diagram

### 5.1.4 Physical Interfacing

Plug-in connections on the operating device for connecting to controllers with various communication modules.

#### 5.1.4.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-25 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

Table 5-26 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Table 5-27 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.1.4.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-28 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

Table 5-29 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

Table 5-30 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |

Table 5-30 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

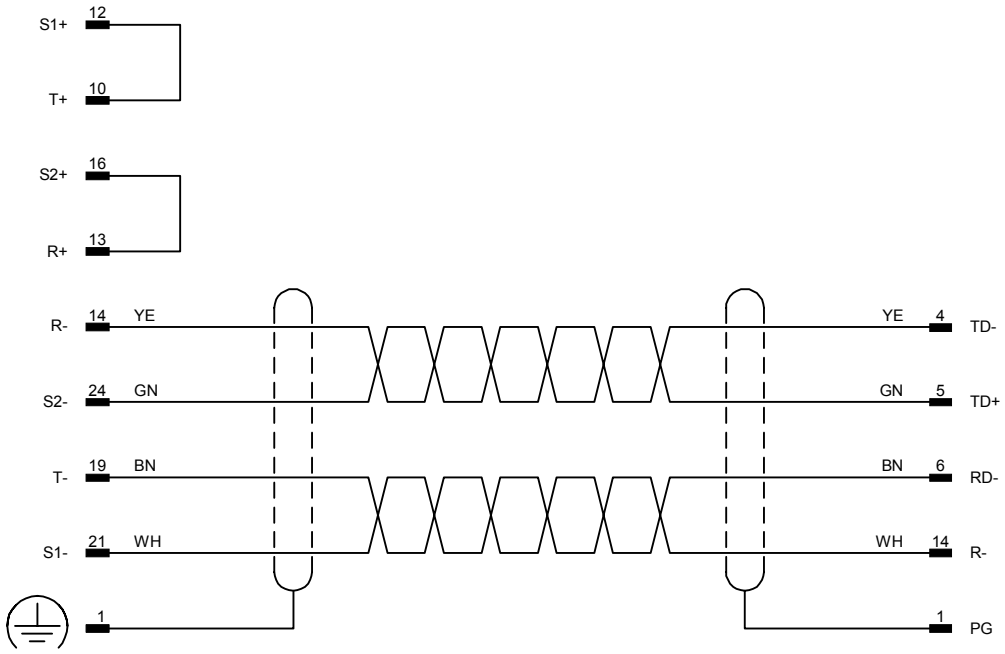
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.1.4.3 Cable X3 SER1 TTY / 20 mA - Siemens S5 CP524/525 and Helmholz SAS 523/525

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device
Transmitting unit active
Receiving unit active

SiemensSimatic S5
CP524/525
Helmholz SAS523/525
Transmitting unit passive
Receiving unit active




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

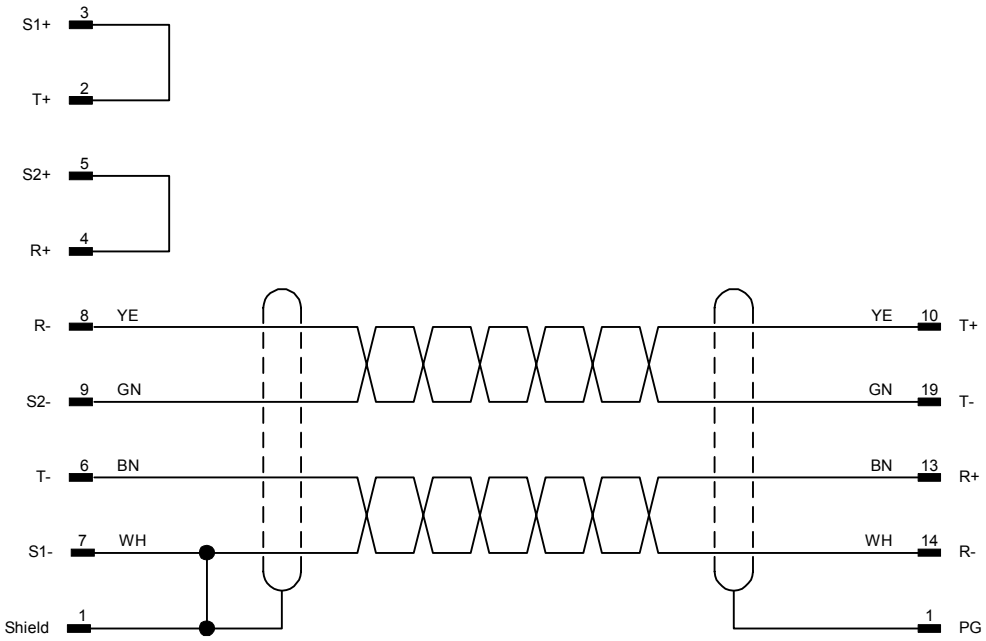
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.4 Cable X2 TTY / 20 mA - Siemens S5 CP524/525 and Helmholz SAS 523/525

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device
Transmitting unit active
Receiving unit active

Siemens Simatic S5
CP524/525
Helmholz SAS523/525
Transmitting unit passive
Receiving unit active




D-SUB
male connector
9 pin

D-SUB
male connector
25 pin

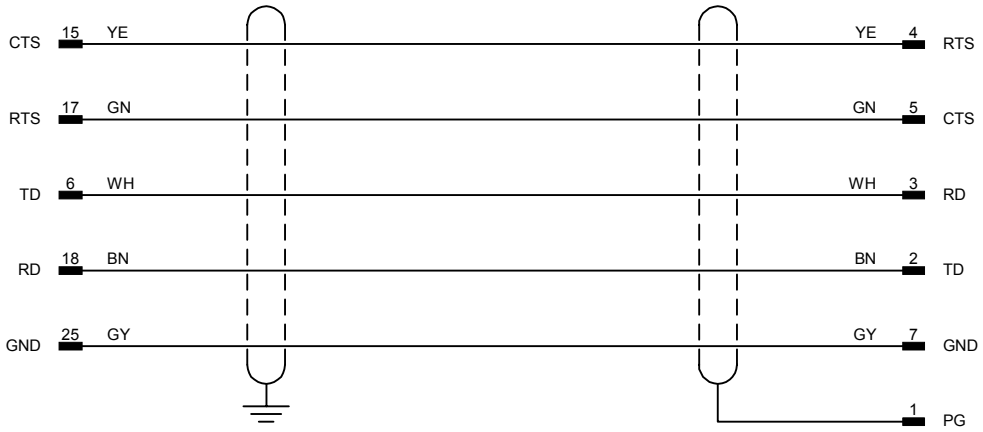
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.5 Cable X3 SER1 RS232 - Siemens S5 CP523/525

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

SiemensSimatic S5
CP523/525




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

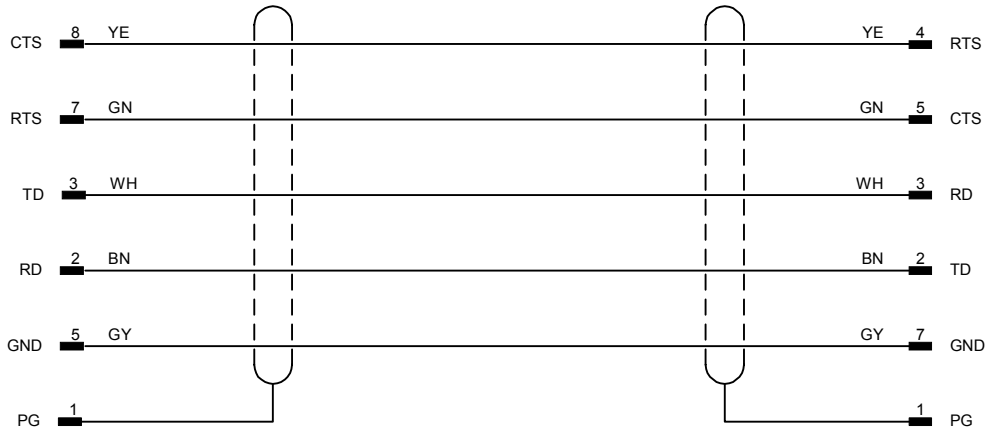
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.6 Cable X2 RS232 - Siemens S5 CP 523/525

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Siemens Simatic S5
CP523/525




D-SUB
male connector
9 pin

D-SUB
male connector
25 pin

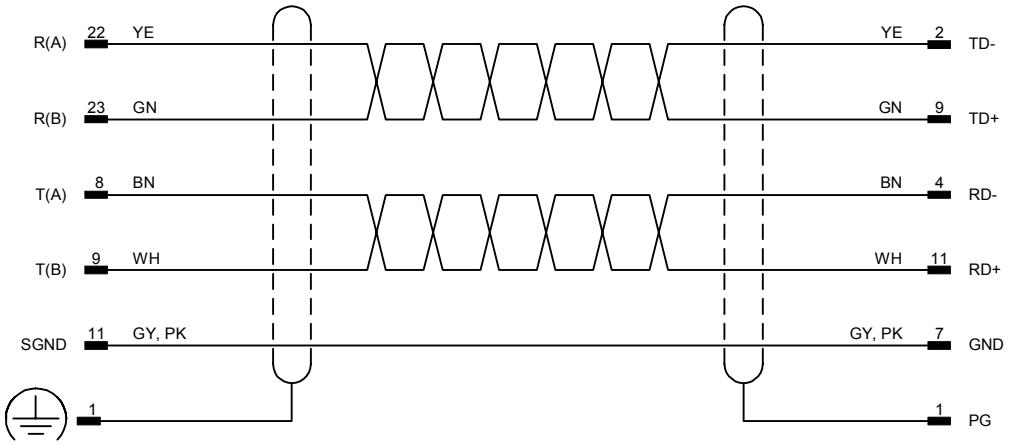
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.7 Cable X3 SER1 RS485 - Siemens S5 CP 523/525

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Siemens Simatic S5
CP523/525




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

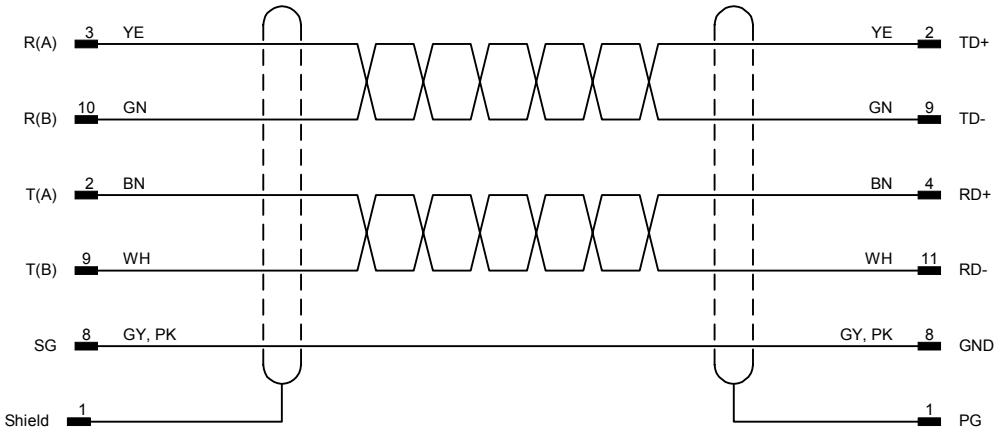
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.8 Cable X2 RS485 - Siemens S5 CP 523/525

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Siemens Simatic S5
CP523/525




D-SUB
male connector
15 pin

D-SUB
male connector
25 pin

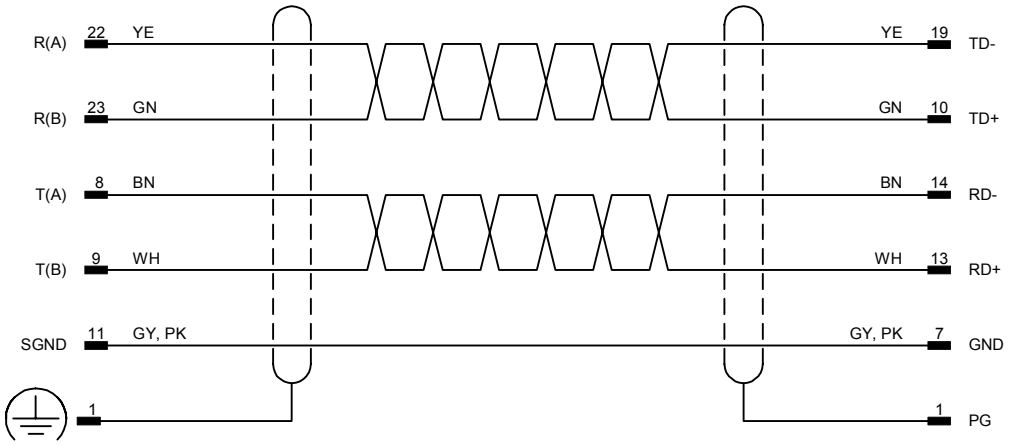
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.9 Cable X3 SER1 RS485 - Siemens S5 with Helmholz SAS 523/525

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Siemens Simatic S5
Helmholz SAS523/525




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

For the communication module SAS 523/525, close the jumpers of the terminating resistors specified in the manufacturer's manual when using the point-to-point to connection.

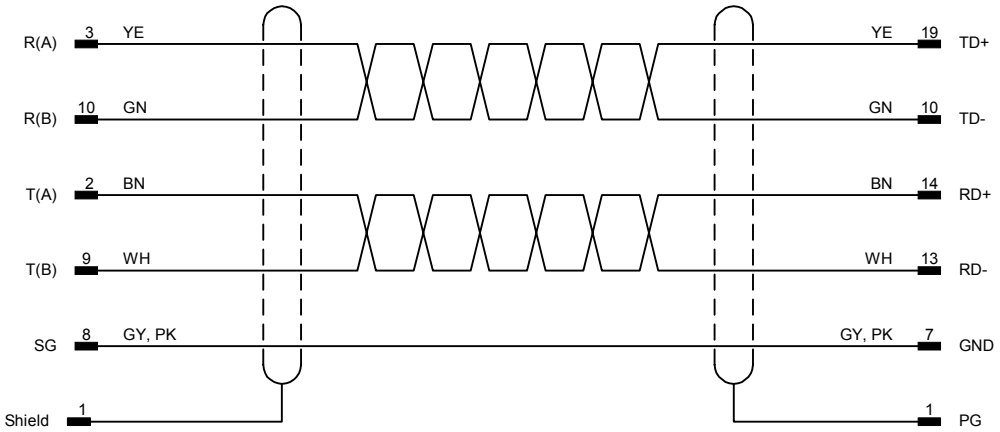
On the operating device, activate the termination for the interface.

### 5.1.4.10 Cable X2 RS485 - Siemens S5 with Helmholz SAS 523/525

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Siemens Simatic S5
Helmholz SAS523/525




D-SUB
male connector
15 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

For the communication module SAS 523/525, close the jumpers of the terminating resistors specified in the manufacturer's manual when using the point-to-point to connection.

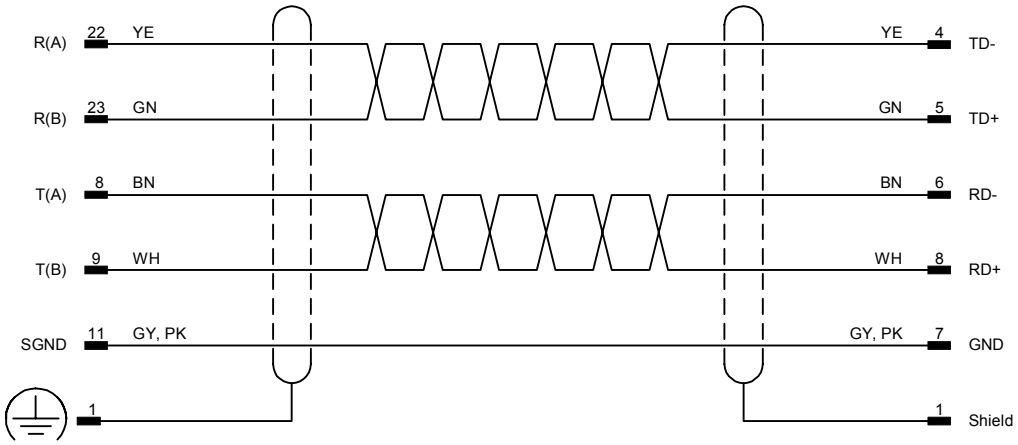
On the operating device, activate the termination for the interface.

#### 5.1.4.11 Cable X3 SER1 RS485 - Siemens S5 with VIPA BGM79-43

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Siemens Simatic S5
VIPA BGM 79-43




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

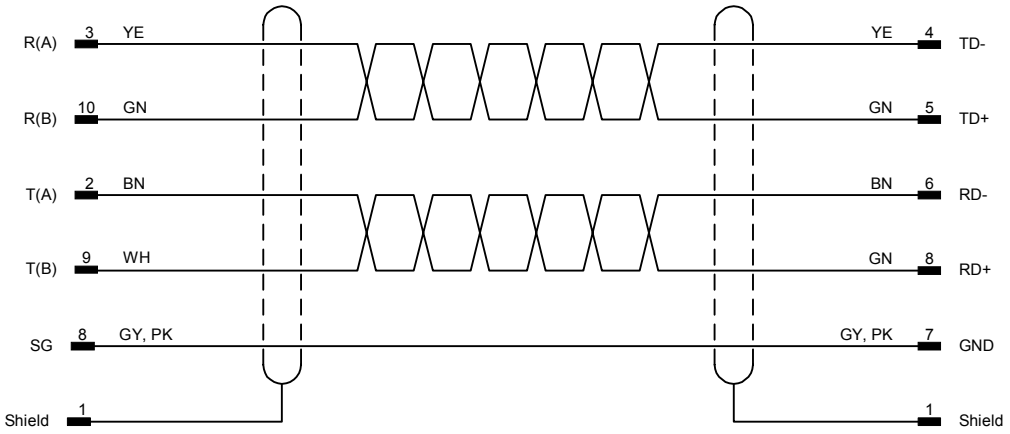
On the operating device, activate the termination for the interface.

### 5.1.4.12 Cable X2 RS485 - Siemens S5 with VIPA BGM79-43

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

SiemensSimatic S5
VIPA BGM 79-43




D-SUB
male connector
15 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

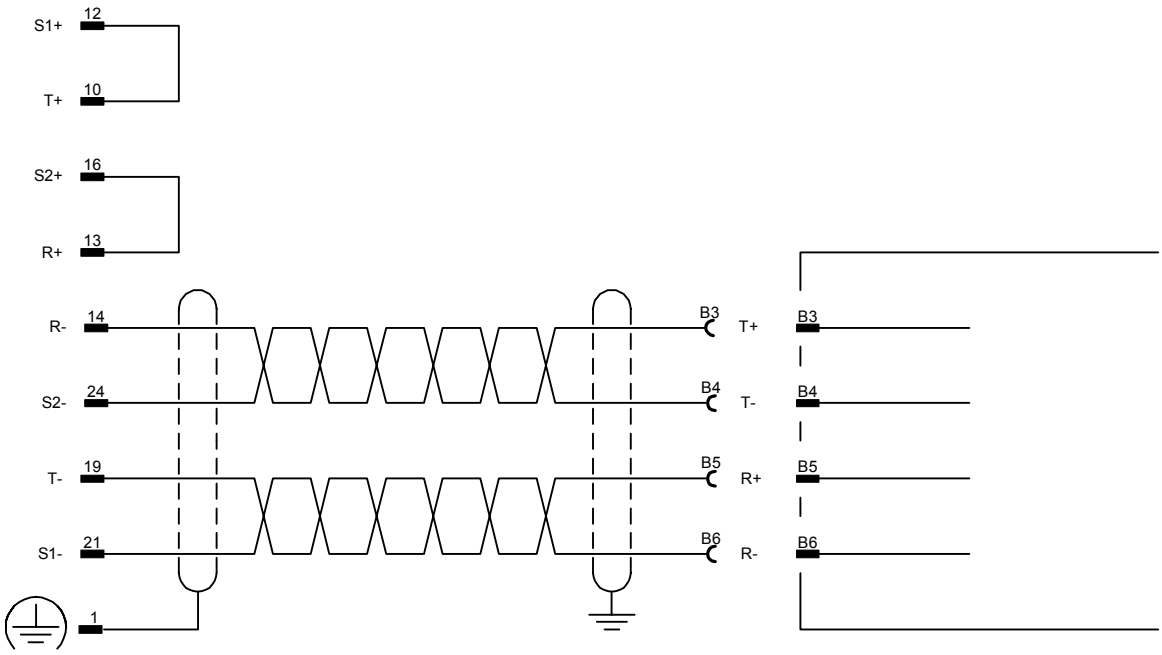
On the operating device, activate the termination for the interface.

#### 5.1.4.13 Cable X3 SER1 TTY / 20 mA - EBERLE PLS514 - K43

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

EBERLE
PLS514
Module K43




D-SUB
male connector
25 pin

VG 95324
DIN 41612
42 pin

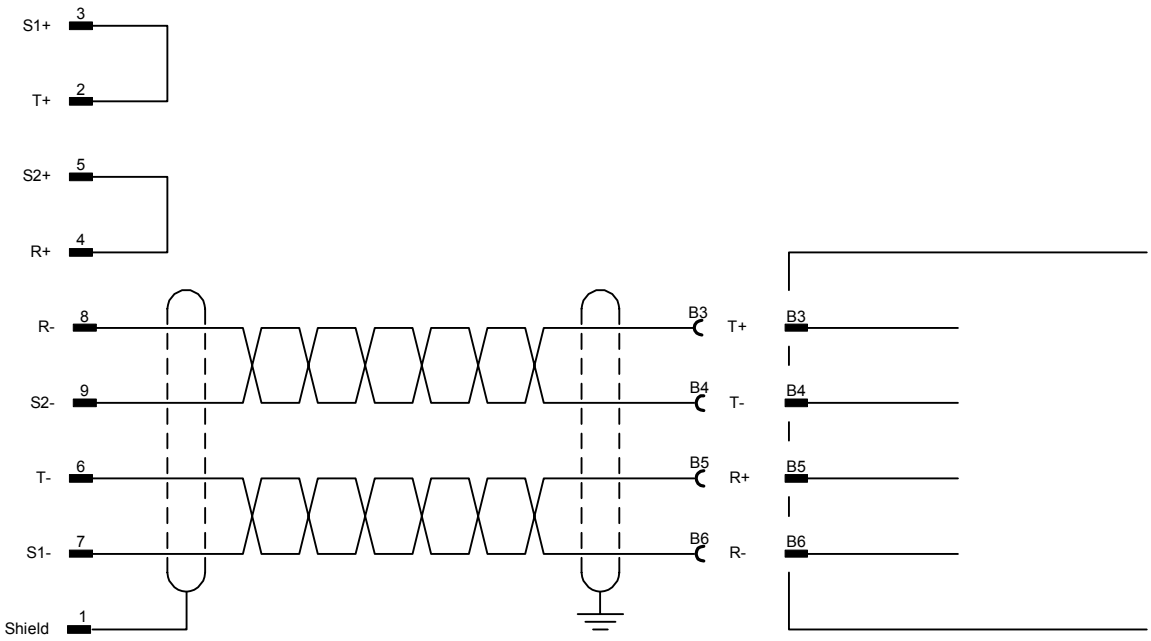
Both ends of the shield are connected to the metallic housing.

#### 5.1.4.14 Cable X2 TTY / 20 mA - EBERLE PLS514 - K43

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

EBERLE
PLS514
Module K43




D-SUB
male connector
9 pin

VG 95324
DIN 41612
42 pin

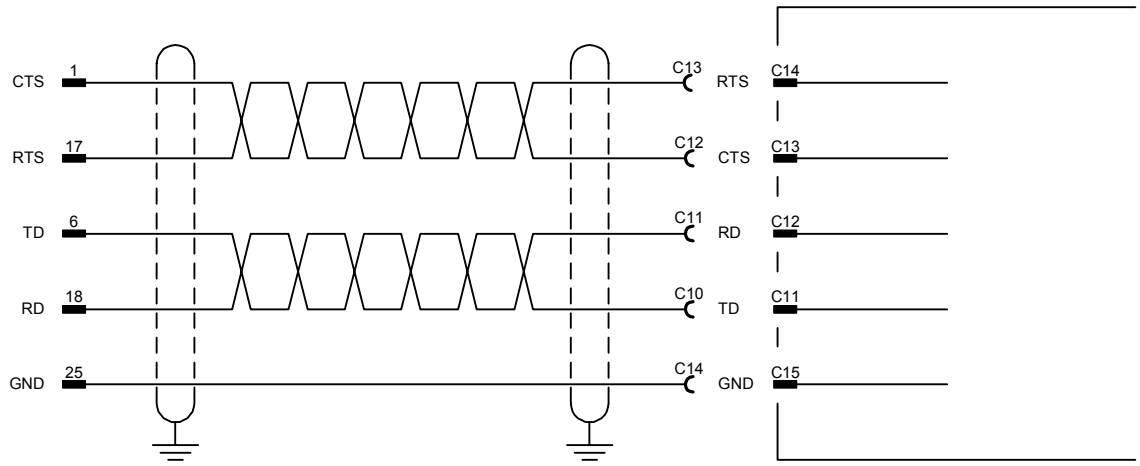
Both ends of the shield are connected to the metallic housing.

### 5.1.4.15 Cable X3 SER1 RS232 - EBERLE PLS514 - K43

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

EBERLE
PLS514
Module K43




D-SUB
male connector
25 pin

VG 95324
DIN 41612
42 pin

Both ends of the shield are connected to the metallic housing.

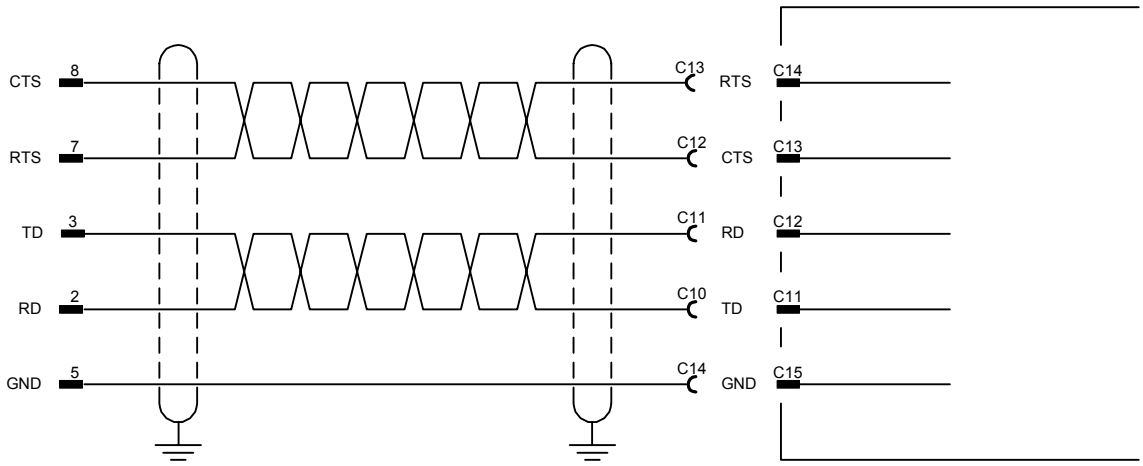
For a communication with the communication module K43 on the EBERLE PLS514, make sure you set the protocol parameter "Handshake" in TSwin to "Software Handshake".

#### 5.1.4.16 Cable X2 RS232 - EBERLE PLS514 - K43

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

EBERLE
PLS514
Module K43




D-SUB
male connector
9 pin

VG 95324
DIN 41612
42 pin

Both ends of the shield are connected to the metallic housing.

### 5.1.5 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-31 Error messages - 3964/RK512

| Code | Subcode | Type of Error | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong slave address or connecting cable not plugged-in properly |
| 2 | | Wrong character | Wrong interface parameters specified |
| 3 | | Byte framing error | |
| 4 | | Waiting time elapsed (Timeout) | Connection interrupted. |
| 5 | | CRC or BCC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 11 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| 50 | | Invalid acknowledgement during connection set-up | |
| 51 | | Invalid acknowledgement after transmission of data | |
| 52 | | No response telegram | |
| 53 | | Incorrect number of data received | Check if the mask, in which the error occured, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| Errors reported by the PLC via the response telegram. | | | |
| 61 | | 10 from PLC | No connection to PLC |
| 62 | | 16 from PLC | Wrong command in telegram |
| 63 | | 20 from PLC | Wrong destination addressed |

Table 5-31 Error messages - 3964/RK512

| Code | Subcode | Type of Error | Possible Cause |
|---|---|---|---|
| 64 | | 50 from PLC | Coordination flag is still set |
| 65 | | 52 from PLC | Number of data transmitted does not comply with the number specified in the telegram header |
| 66 | | 54 from PLC | Awaiting continuation telegram |
| 70 | | The subcode contains the error transmitted by a CP525 or compatible module in the response telegram. | |
| | 10 | | No connection to PLC |
| | 12 | | Starting address too high. Use of coordination flag not permitted for this data type. CPU no. too high. |
| | 16 | | Wrong command letter |
| | 20 | | Illegal command. DB does not exist. DB too short. |
| | 50 | | Coordination flag still set |
| | 52 | | The number of data received exceeds the number requested. |
| | 54 | | Synchron. error (continuation telegram expected). |

## 5.1.6 Applications

For a connection to the Siemens Simatic S5 controllers, you need to set up function blocks. The function blocks are copied into subdirectories during installation of TS-win.

Table 5-32 Directories for the function blocks

| Simatic Type | FB Number | Directory |
|---|---|---|
| S5 115U | FB186 | C:\Program Files\TSwin\FBs\3964R\AG115 |
| S5 135U | FB186 | C:\Program Files\TSwin\FBs\3964R\AG135 |

### 5.1.6.1 Connection to Siemens S5 115U

For connection to the Siemens Simatic S5 115U, you need to carry out the following steps:

– Transfer the function block FB186 to the controller.
– Create the data block for the communication (which you also specified in the TS-win protocol parameters) in the controller's RAM with a size of at least 128 bytes or 64 data words.

Call up function block FB186 with the following parameters:

– data block for the communication
– coordination flag

The function block supports the following destination specifications for write accesses via a data block:

Table 5-33 Supported destination specifications for Siemens S5 115U

| Data Type | Mnemonics | Byte 1 (Command) | Byte 2 (Number) | Byte 3 | Byte 4 |
|---|---|---|---|---|---|
| Output Bit | A | 11 | 1 Byte | Bit No. | Offset |
| Output Byte | AB | 2 | n Bytes | Offset | |
| Flag Bit | M | 12 | 1 Byte | Bit No. | Offset |
| Flag Byte | MB | 3 | n Bytes | Offset | |

**Example:** Connection to a Simatic S5 115U with CP525

In this example:

– The data block for the communication has the address DB33 DW0.
– The address of the coordination flag is M100.3.
– They are to write onto flag 50.

Activate the coordination flag (which Siemens also refers to as 'communication flag') by use of a hardware jumper.

For information refer to the operating instructions for the CP525 communication block .

Enter the coordination flag into data block DB1 of the S5 115U as shown below:

```
DB1:
DW 0: KH = 4D41 \
```

```
   1: KH = 534B > „MASK01“Header identifier
   2: KH = 3031 /

DW 3: KH = CA00            Output communication flag
   4: KF = 100             MB100

DW 5: KH = EEEE End identifier
```

Use the following structure in OB1 (the block which is called at cyclic intervals).

```
   : .
   : .
   : SPA FB245             RECEIVE block call-up
NAME:REC-ALL
   .
ANZW:MW220                 The communication flag number is
   .                       transferred in the indicator word parameter of the
   .                       RECEIVE-block.
   .
   : L MB221               If the LOW byte contains the specified
   .                       communication flag
   : L KF+100
   .!=F
   :S M 100.3              it must be set here.
   : .
   : .
   : SPA FB186             Evaluation block
   .                       Processes the data from the communication
   .                       data block and resets
   .                       flag 100.3.
```

#### 5.1.6.2 Connection to EBERLE PLS514 with communication block K43

The protocol parameters to set for a communication with the EBERLE PLS514 with the communication module K43 depend on the interface used.

Always access timer, BCD numbers and counters with double words (32 bits).

#### 5.1.6.2.1 Protocol Parameters for TTY / 20 mA

Table 5-34 Protocol parameters for TTY / 20 mA

| Parameter | Value |
|---|---|
| Baud rate | 9600 Baud |
| Parity | Even |
| Handshake | No Handshake |
| Data Bits | 8 |
| Stop Bits | 1 |
| Use Coordination Flag | OFF |
| Coordination Flag | 0 |
| Bit Number | 0 |
| Data Block Number | 0 |
| Data Block Word | 0 |
| Floating Point Number in the Siemens Format | Siemens Format |
| Block Check | 0 |
| CPU Number | 0 |
| Full Duplex | ON |
| Half Duplex | OFF |

#### 5.1.6.2.2 Protocol Parameters for RS232

Table 5-35 Protocol parameters for TTY / 20 mA

| Parameter | Value |
|---|---|
| Baud Rate | 9600 Baud |
| Parity | Even |
| Handshake | No Handshake |
| Data Bits | 8 |
| Stop Bits | 1 |
| Use Coordination Flag | OFF |
| Coordination Flag | 0 |
| Bit Number | 0 |
| Data Block Number | 0 |
| Data Block Word | 0 |
| Floating Point Number in the Siemens Format | Siemens Format |
| Block Check | 0 |

Table 5-35 Protocol parameters for TTY / 20 mA

| Parameter | Value |
|---|---|
| CPU Number | 0 |
| Full Duplex | ON |
| Half Duplex | OFF |

#### 5.1.6.2.3 Initializing the K43 module

Initialize the K43 module with the values contained in the INI.IL file. The values in this file must be set as follows:

```
{Initialisierung des K43 Moduls}
{*********************************************************}
{ Programmbaustein: INI.PBS}
{ Versionsnummer: 01 01}
{ Keine Änderung im Programm}
{ *********************************************************}
{ }
{ *********************************************************}
{ Initialisierung des K43}
{ *********************************************************}
{ Dieses Programm dient zur Initialisierung des }
{ Kommunikationsmoduls K43.}
{ Die Initialisierung erfolgt selbständig nach-}
{ dem Einschalten der Versorgungsspannung der }
{ PLS 514.}
{ Im ersten Zyklus der PLS 514 werden die benötigten}
{ Merker initialisiert und das Initialisierungsprogramm }
{ aufgerufen.}
{ Im Initialisierungsprogramm werden die Parameter für}
{ das Modul K 43 übergeben. Dieses Programm ist nicht }
{ notwendig, wenn die Default-Einstellung verwendet wird.}
{ Nach der Initialisierung wird automatisch in die }
{ Betriebsart Datenaustausch mit K 43 umgeschaltet.}
{ Maßgebend für die jeweilige Betriebsart des K 43 ist das}
{ Kommandodigit. }
{ Das Kommandodigit ist das Digit 3 der Ebene 0.}
{ Die einzelnen Bits haben folgende Bedeutung.}
{ Bit 3 2 1 0}
{ ___________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
{ ! ! ! ! !}
{ ————————}
{ ! ! ! !}
{ ! }
{ ! ! ! 0 = Kein SW-Reset }
{ ! 1 ! 1 = SW-Reset}
{ ! }
{ ! ! X = Keine Bedeutung}
{ !}
{ ! 0 = K 43 Betriebsart passiv}
{ ! 1 = K 43 sendet über V.24 TTY}
{ 0 = Initialisierung}
{ 1 = Datenaustausch mit K 43 aktiv}
{ Im ersten Zyklus rücksetzen des Initialisierungs-}
{ schieberegisters und der benötigten Merker }
{ Um den Selbsttest des Schnittstellenmoduls K 43 }
{ zu überbrücken ist eine Einschaltverzögerung in }
{ der PLS 514 notwendig. Diese wird über den Hilfs-}
{ zähler #Z0 bis #Z2 erzeugt.}
{ ————————————————————}
```

```
L %ZK1LD %K 0=D INIREG=D Z0=D Z1=D Z2=D DW_ZV_0=D DW_ZV_1=D DW_ZV_2=D DW_ZV_3L
%MS10ZV Z0ZV Z1ZV Z2L %K 1LD Z2GL %K 2LD INIREGGL %K 0S INIREG0
{ Initialisierung des Protokolls:}
{ ==============================}
{ Für die Initialisierung des Protokolls haben die }
{ Digits 0 .. 2 der Ebene 0 und die Digits der Ebene 1}
{ die jeweils beschriebene Bedeutung}
DAL K43_E0L INIREG0A DACK = %NOP
{ Definition des Kommandodigits Digit 3 der Ebene 0}
{ ————————————————————}
{ Einstellen der Datenübertragung zum K 43 auf }
{ Initialisierung-Modus}
{ Digit 0xx3}
{ Bit 3 2 1 0}
{ ___________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
{ ! ! ! ! !}
{ —————————}
{ ! ! ! !}
{ ! }
{ ! ! ! 0 = Kein SW-Reset }
{ ! 1 ! 1 = SW-Reset}
{ ! }
{ ! 0 = K 43 Betriebsart passiv}
{ ! 1 = K 43 sendet über V.24 TTY}
{ 0 = Initialisierung}
{ 1 = Datenaustausch mit K 43 aktiv}
{ Eingabe der Konstanten 00 in das Digit 0xx3 }
{ d.h. Initialisierung des K 43 }
{ ohne SW-Reset}
{ Protokoll initialisieren gemäß Ebene 0, }
{ Digit 0...2 und Ebene 1, Digit 0...7}
LD %K 0=D KOMMAND
{ Initialisierung über Ebene 0 Digit 0,1 und 2:}
{ ————————————————————}
{ Digit 0xx0}
{ Bit 3 2 1 0}
{ ___________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
{ ! ! ! ! !}
{ —————————}
{ ! ! ! !}
{ ! }
{ ! 0 0 0 = 110 Baud }
{ ! 0 0 1 = 300 Baud }
{ ! 0 1 0 = 600 Baud }
{ ! 0 1 1 = 1200 Baud }
{ ! 1 0 0 = 2400 Baud }
{ ! 1 0 1 = 4800 Baud }
{ ! 1 1 0 = 9600 Baud }
{ ! 1 1 1 = 19200 Baud }
{ 0 = Datenformat 7 Bit }
{ 1 = Datenformat 8 Bit }
{ Eingabe der Konstanten 14 in das Digit 0xx0 }
{ d.h. 9600 Baud, Datenformat 8 Bit}
LD %K 14=D Data00
{ Digit 0xx1}{ ———————}
{ }
{ Bit 3 2 1 0}
{ ___________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
```

```
{ ! ! ! ! !}
{ ————————}
{ ! ! ! !}
{ ! ! !}
{ ! ! ! 0 = kein Parity-Bit, keine Prüfung (none)}
{ ! ! ! 1 = Parität wie Bit 1.1 und 1.2}
{ ! ! }
{ ! 0 0 1 = Prüfung auf ungerade Parität (odd)}
{ ! 1 0 1 = Prüfung auf gerade Parität (even)}
{ ! }
{ ! 0 1 1 = Parity-Bit immer auf „1" gesetzt (mark)}
{ ! keine Prüfung }
{ ! 1 1 1 = Parity-Bit immer a. „0" gesetzt (space)}
{ ! keine Prüfung }
{ 0 = 1 Stop Bit}
{ 1 = 2 Stop Bit}
{ Eingabe der Konstanten 05 in das Digit 0xx1 }
{ d.h. gerade Paritöt, 1 Stop Bit }
{ }
LD %K 5=D Data01
{ DIGIT 0xx2}
{ ——————}
{ Bit 3 2 1 0}
{ ____________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
{ ! ! ! ! !}
{ ————————}
{ ! ! ! !}
{ ! ! !}
{ ! ! ! 0 = RTS/CTS eingeschaltet}
{ ! ! ! 1 = RTS/CTS ausgeschaltet}
{ ! ! }
{ ! ! 0 = V 24}
{ ! ! 1 = TTY}
{ ! }
{ ! 0 = aktives Senden mit niedriger Priorität}
{ ! 1 = aktives Senden mit hoher Priorität}
{ 0 = Protokoll 3964 aktiv}
{ 1 = Protokoll 3964 R aktiv}
{ Eingabe der Konstanten 09 in das Digit 0xx2 bei RS232 }
{ Eingabe der Konstanten 11 in das Digit 0xx2 bei TTY }
{ d.h. Handshake XON/XOFF, V24-Schnittstelle, }
{ niedrige Priorität, Protokoll 3964 R aktiv.}LD %K 11=D Data02 { Initialisie-
rung der Ebene 1}
{ ============================}
{ Die Initialisierung der Datenbausteine erfolgt im }
{ hexadezimalen Code. Bei der Angabe des entsprechenden}
{ Zeichens wird jede Stelle einzeln eingegeben. }
{ D.h. zwei Halbbytes ergeben ein Zeichen und müssen demzu-}
{ folge in zwei Digits eingetragen werden.}
{ }
{ Initialisierung des 0. Datenbausteine}{ ————————————————}
{ Digit 1xx0 niederwertiges Halbbyte des 0. Datenbausteins}
{ Digit 1xx1 höherwertiges Halbbyte des 0. Datenbausteins}{ }
{ —> z.B. 1. Datenbaustein auf 32 dez. => 20 hex. }
{ }
LD %K 0 =D Data10 LD %K 2 =D Data11
{ Initialisierung des 1. Datenbausteins}
{ ————————————————}
{ }
{ Digit 1xx2 niederwertiges Halbbyte des 1. Datenbausteins}
{ Digit 1xx3 höherwertiges Halbbyte des 1. Datenbausteins}
{ —> z.B. 1. Datenbausteins auf 33 dez. => 21 hex. }
```

```
LD %K 1 =D Data12LD %K 2 =D Data13
{ Initialisierung des 2. Datenbausteins}
{ ——————————————————}
{ Digit 1xx4 niederw. Halbbyte des 2. Datenbausteins}
{ Digit 1xx5 höherwert. Halbbyte des 2. Datenbausteins}
{ —> z.B. 2. Datenbausteins auf 34 dez. => 22 hex. }
{ }LD %K 2 =D Data14LD %K 2=D Data15
{ }
{ Initialisierung des 3. Datenbausteins }
{ ——————————————————}
{ Digit 1xx6 niederw. Halbbyte 3. Datenbausteins }
{ Digit 1xx7 höherwert. Halbbyte des 3. Datenbausteins }
{ }
{ —> z.B. 3. Datenbausteins auf 35 dez. => 23 hex. }
LD %K 3=D Data16LD %K 2 =D Data17
{ Beenden der Initialisierung}
{ ————————————}
SL INIREGDAS K43_E0DAS K43_E1DAL K43_E0R %NOP
{ Start der Datenübertragung}
{ ==========================}
{ Nachdem die Initialisierung beendet ist, wird die}
{ Datenübertragung durch setzen des Kommandodigits }
{ freigegeben.}
{ Bedeutung des Kommandodigits wahrend der Datenübertragung}
{ Bit 3 2 1 0}{ ____________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
{ ! ! ! ! !}
{ —————————}
{ ! ! ! !}
{ ! }
{ ! ! ! 0 = Kein SW-Reset }
{ ! 1 ! 1 = SW-Reset}
{ ! }{ ! 0 = K 43 Betriebsart passiv}
{ ! 1 = K 43 sendet über V.24 TTY}
{ 0 = Initialisierung}
{ 1 = Datenaustausch mit K 43 aktiv}
{ Definition des Kommandodigits Digit 3 der Ebene 0}
{ durch die Konstante 08}
{ d.h. Datenübertragung mit Blockübertragungs-Mode}
{ ——————————————————————}
L INIREG1A DACK = %NOP LD %K 8=D KOMMAND { Weiterschalten der Initialisierung}
{ ——————————————————}SL INIREGDAS K43_E0DAS K43_E1DAL K43_E0R %NOP
{ ********************************************************}
{ Reset des K 43}{ ********************************************************}
{ SW_Reset des K 43 über den Merker #Bed_Res}
{ durch setzen des Kommandodigits }
{ Bedeutung des Kommandodigits}
{ Bit 3 2 1 0}
{ ____________________}
{ ! ! ! ! !}
{ ! X ! X ! X ! X !}
{ ! ! ! ! !}
{ —————————}
{ ! ! ! !}
{ ! }
{ ! ! ! 0 = Kein SW-Reset }
{ ! 1 ! 1 = SW-Reset}
{ ! }
{ ! 0 = K 43 Betriebsart passiv}
{ ! 1 = K 43 sendet über V.24 TTY}
{ 0 = Initialisierung}
{ 1 = Datenaustausch mit K 43 aktiv}
{ Definition des Kommandodigits Digit 3 der Ebene 0}
```

```
{ durch die Konstante 9}
{ d.h. Datenübertragung und SW-Reset }
{ ————————————————————————}
L Bed_ResA Inireg2A DACK = %NOP LD %K 12=D KOMMAND
{ Initialisierungsprogramm neu aufrufen}
{ ——————————————————}
LD %K 0=D INIREGDAS K43_E0DAS K43_E1DAL K43_E0R %NOP VarBed_Res % 0007.0
{ Bedingung zum Reset K 43}
INIREG % 0270
{ Ini. SCHIEBEREGISTER}
INIREG0 % 0270.0
{ Ini. PROTOKOLLS}
INIREG1 % 0270.1
{ Ini. DATENŠBERTRAGUNG}
DW_ZV_2 % 0273
{ Datenwort Zöhler 2}
DW_ZV_3 % 0274
{ Datenwort Zöhler 3}
Z0 % 0275
{ Hilfszähler 0}
Z1 % 0276 { Hilfszähler 1}
Z2 % 0302
{ Hilfszähler 2}
End_Var
```

## 5.2 3S sarti

The 3S sarti protocol connects a TesiP@n control panel with TSvisRT CE to the CoDeSys SP runtime system as a SymARTI client. It provides random read and write access to all global data objects of the soft PLC.

TSwin adopts the data objects of the project_name.SYM file which are created when the CoDeSys project is compiled.

The TesiP@n control panel uses the symbolic name to access a data object of the Symbol Data Dictionary (SDD) file.

After booting, the AppStarter.exe file is executed in the TesiP@n control panel to load the files SymArtiClient.dll and ARTIClient.dll. The PLCCEARM.exe file is then started. This file starts the soft PLC and loads the application.

### 5.2.1 Data Types

The length of a variable is determined by the length defined in the programming software CoDeSys.

#### 5.2.1.1 Single Variables

You can access variables of the following type: BOOL, BYTE, WORD, DWORD, SINT, INT, DINT, USINT, UINT, UDINT, REAL, and STRING. Floating point numbers are interpreted in IEEE format. The variable type REAL is required for this purpose.

#### 5.2.1.2 String Variables

For string variables, the variable type STRING(N) is used, where N is the length of the string.

Please note that the length of the string variables in the symbol file is by 1 larger than defined.
Example: STRING(40) has a length of 41.

## 5.2.2 Programming

### 5.2.2.1 Protocol Parameters

#### 5.2.2.1.1 Path for Variable List *.sym

This parameter specifies the directory in which the variable list *.sym is stored.

To select a directory, click the Browse button.

The variable list *.sym is created by the programming software **CoDeSys** when compilation takes place.

CoDeSys enters only global variables into the variable list *.sym!

### 5.2.2.2 System Parameters

#### 5.2.2.2.1 Poll Area

The poll area is used to manage the write coordination byte, the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

This protocol requires you to set up the poll area with three single variables.

Table 5-36 Data types for the poll area

| Area | Valid Data Types |
|---|---|
| KBS (write coordination byte) | BYTE, USINT, WORD, UINT |
| Message Channel | WORD, UINT |
| Function Key LEDs | BYTE, USINT, WORD, UINT, DWORD, UDINT, ARRAY[1..N] |

#### 5.2.2.2.2 Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device. For status message addressing, use the data types BYTE, USINT, WORD, UINT, DWORD, UDINT, or ARRAY[1..N]. The following applies when using ARRAY: The type size multiplied by N provides the size of the message system in bytes.

#### 5.2.2.2.3 Date and Time

The variables for synchronizing the time and date must use the data types USINT or ARRAY [1..N] OF BYTE.

Table 5-37 Byte lengths for the date and time

| Variable | Length |
|---|---|
| Date with a 2-digit year | 3 Bytes |
| Date with a 4-digit year | 4 Bytes |
| Time | 3 Bytes |
| Weekday | 1 Byte |

#### 5.2.2.2.4 Variant Buffer

The variable for the variant buffer must use the data type BYTE or USINT.

#### 5.2.2.2.5 Tables

If the variable is used in table fields, the data type ARRAY [1..N] must be used. ARRAY [1..N] must be of one of the following base types:

- BOOL
- BYTE
- WORD
- DWORD
- SINT
- INT
- DINT
- USINT
- UINT
- UDINT
- REAL or
- STRING.

### 5.2.3 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-38 3S sarti error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 51 | 02 | Memory overrun | |
| 60 | 02 | Channel to the CoDeSys SP can not be opened | |
| | 03 | Login command can not be executed | |
| | 04 | Login command can not be terminated | |
| | 08 | Symbol table in CoDeSys SP not found | |
| 61 | 08 | Symbol table in CoDeSys SP not found | |
| | 09 | Wrong access to symbol table in CoDeSys SP | |
| | 10 | Symbol table was changed on server, but not updated on client after 3 repetitions | |
| | 11 | Variable in symbol table not found | |
| | 12 | Wrong access to symbol table in CoDeSys SP | |
| | 13 | Wrong access to symbol table in CoDeSys SP | |
| | 14 | The variable is not the first item in the table | |
| 80 | 20 | Variable types not the same | Recompile the project using the current symbol file and load it into the operating device again. |
| | 30 | Invalid symbol | |

## 5.2.4 Applications

### 5.2.4.1 CoDeSys Version 2.2 or Higher

The programming software takes the global variables from the symbol file project_name.SYM and inserts them into the variable list.

The symbolic names cannot be longer than 80 characters.

The entries in the variable list cannot be modified.

#### 5.2.4.1.1 Declaring Global Variables

To declare global variables in CoDeSys:

1. Select **Auto Declare** from the **Edit** menu.

The **Declare Variable** dialog opens.

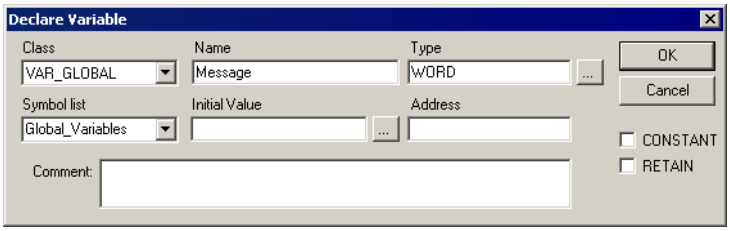



Figure 5-2 Example of a variable declaration for global variables

2. Select the VAR_GOBAL class from the **Class** field.
3. Enter a name (Message) and a type (WORD).
4. Repeat step 3 for all additional global variables.
5. Click **OK** to confirm your input.

The **Global_Variables** window opens.

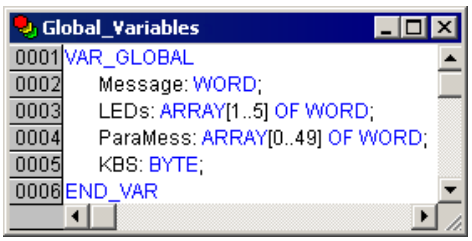



Figure 5-3 Window 'Global variables'

#### 5.2.4.1.2 Activate Output into Symbol File

Specify the following settings in CoDeSys to write the global variables into a symbolic file.

1. Select **Options** from the **Project** menu.
2. Select **Symbol configuration**.

The **Options** dialog will look as follows.

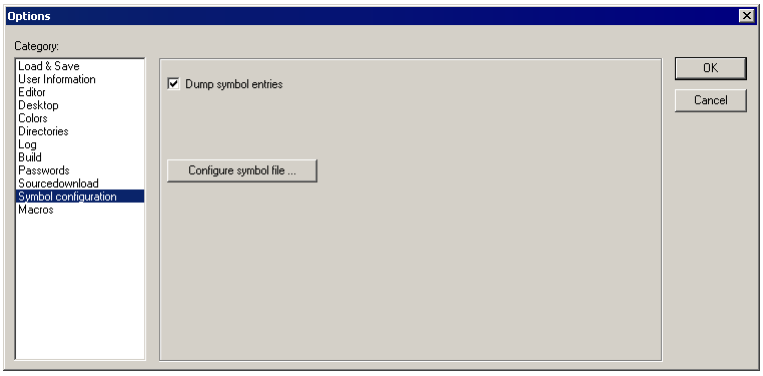



Figure 5-4 Dialog 'Options' - symbol configuration

3. Select the **Dump symbol entries** check box.
4. Click the **Configure symbol file** button.

The **Set object attributes** window opens.

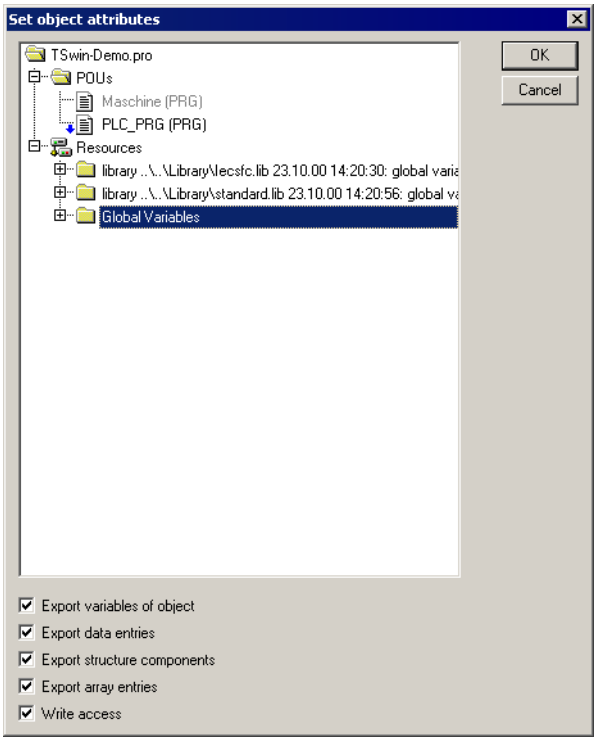



Figure 5-5 Dialog 'Set object attributes'

5. Select the **Global variables** entry.
6. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

Now you need to specify the position where the symbol file is to be stored.

1. Select **Directories** from the **Options** dialog.

The **Options** dialog will look as follows.

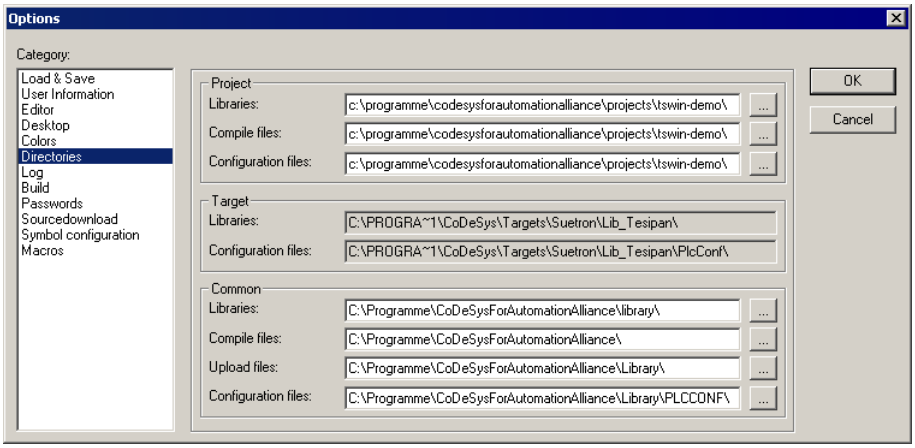



Figure 5-6 Dialog 'Options' - directories

2. From the **Project** area, select a directory for the **compile files**.
3. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

The symbol file will not be created until a compilation process takes place and is stored in the same directory as the project!

#### 5.2.4.1.3 Target System Settings

Select the following settings for the target system to ensure the symbol file is sent to the target system:

1. Open the **Resources** tab.
2. Double-click **Target settings**.

The **Target settings** dialog opens.

3. Open the **General** tab.
4. Select the **Download Symbol File** check box.

The **Target settings** dialog might look like the example below:

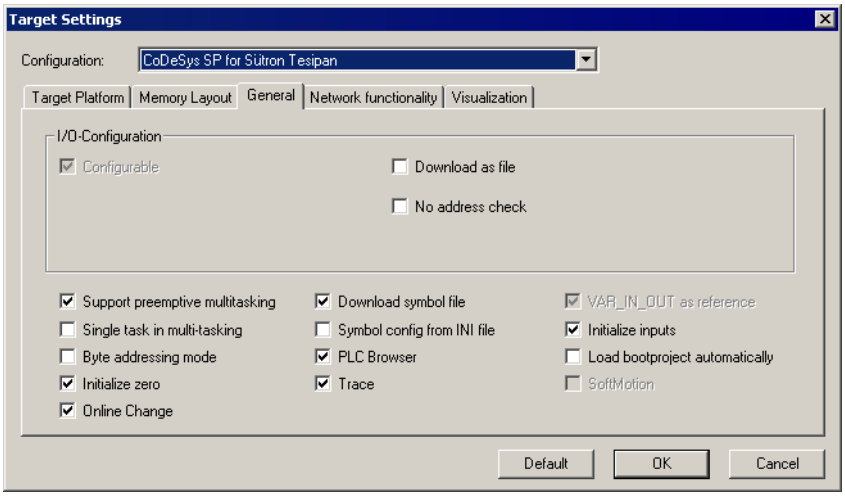



Figure 5-7 Dialog 'Target settings'

## 5.3 3S serial

The protocol provides random read and write access to all global data objects of the controller.

The programming software adopts the data objects of the project_name.SYM file which are created when the CoDeSys project is compiled.

The connected operating device uses the symbolic name to access a data object.

### 5.3.1 Data Types

The length of a variable is determined by the length defined in the programming software CoDeSys.

#### 5.3.1.1 Single Variables

You can access variables of the following type: BOOL, BYTE, WORD, DWORD, SINT, INT, DINT, USINT, UINT, UDINT, REAL, and STRING. Floating point numbers are interpreted in IEEE format. The variable type REAL is required for this purpose.

#### 5.3.1.2 String Variables

For string variables, the variable type STRING(N) is used, where N is the length of the string.

## 5.3.2 Programming

### 5.3.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.3.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-39 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 4800 | |
| 9600 | |
| 19200 | |
| 38400 | X |

#### 5.3.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-40 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.3.2.1.3 Data Bits

This parameter specifies the number of data bits.

Table 5-41 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.3.2.1.4 Stop Bits

This parameter specifies the number of stop bits.

Table 5-42 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.3.2.1.5 Waiting Time for Response

Specify a waiting time for the Produced Data toggle bit monitoring.

Table 5-43 Waiting time for response

| Configurable Values | Default Value |
|---|---|
| 0 ms, 50 ms to 65000 ms | 500 ms |

#### 5.3.2.1.6 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-44 Delay until Connection Set-Up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.3.2.1.7 Byte Order

This parameter specifies the destination hardware's CPU type.

Table 5-45 Byte order

| Configurable Values | Default Value |
|---|---|
| Intel | |
| Motorola | X |

#### 5.3.2.1.8 Controllers

This parameter is reserved for future extensions.

Table 5-46 Controllers

| Configurable Values | Default Value |
|---|---|
| Standard | X |
| PLCWinNT | |

#### 5.3.2.1.9 Path for Variable List *.sym

This parameter specifies the directory in which the variable list *.sym is stored.

To select a directory, click the Browse button.

The variable list *.sym is created by the programming software **CoDeSys** when compilation takes place.

| Area | Permitted Data Types |
|---|---|
| CBW | BYTE |
| Message Channel | WORD |
| LEDs in the Function Keys | ARRAY[1..N] OF BYTE |

Table 5-47 Dats types for the poll area

#### 5.3.2.2 System Parameters

##### 5.3.2.2.1 Poll Area

The poll area is used to manage the write coordination byte, the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

This protocol requires you to set up the poll area with three single variables.

##### 5.3.2.2.2 Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device. For status message addressing, use the data types ARRAY[1..N] OF BYTE or ARRAY[1..N] OF WORD.

Table 5-48 Length of the Message System in Bytes

| Data Type | Length of the message system in bytes |
|---|---|
| ARRAY OF BYTE | N |
| ARRAY OF WORD | N x 2 |

##### 5.3.2.2.3 Date and Time

The variables for synchronizing the time and date must use the data type ARRAY [1..N] OF BYTE.

Table 5-49 Byte lengths for the date and time

| Variable | Length |
|---|---|
| Date with a 2-digit year | 3 Bytes |
| Date with a 4-digit year | 4 Bytes |
| Time | 3 Bytes |
| Weekday | 1 Byte |

#### 5.3.2.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

##### 5.3.2.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-50 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

##### 5.3.2.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-51 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

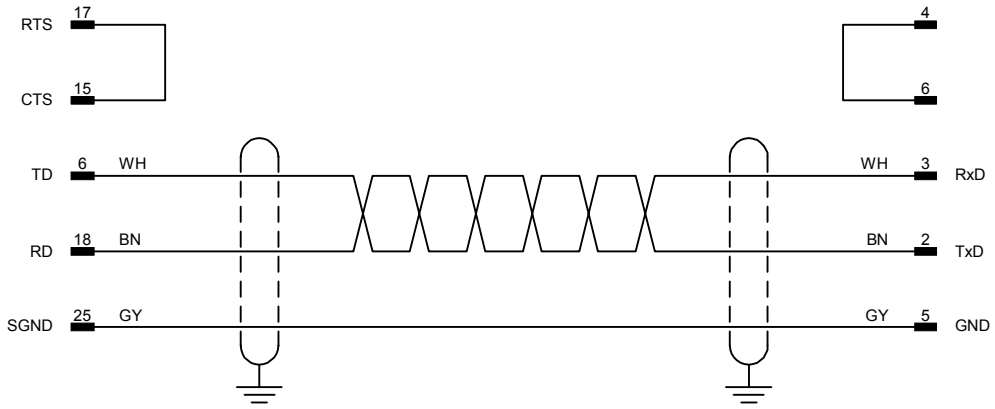
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.3.2.3.3 Cable X3 SER1 RS232 - Schraml PLC FWM105

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Schraml
FWM105




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

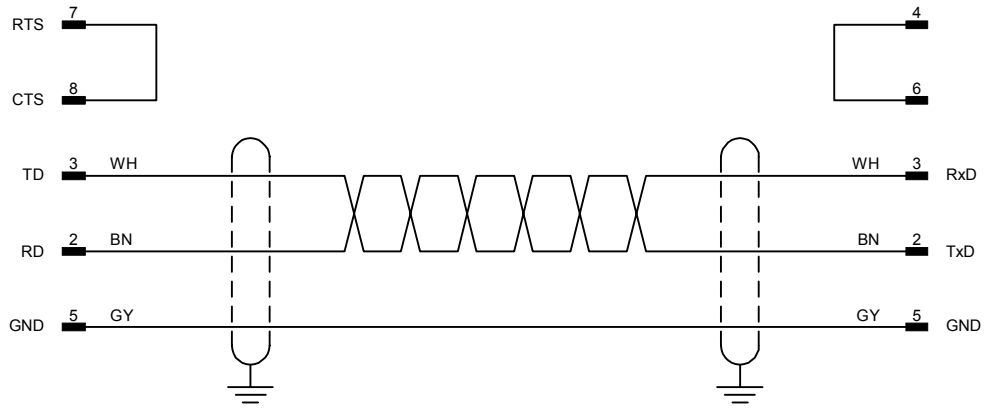
Both ends of the shield are connected to the metallic housing.

#### 5.3.2.3.4 Cable X2 RS232 - Schraml SPS FWM105

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Schraml
FWM105




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

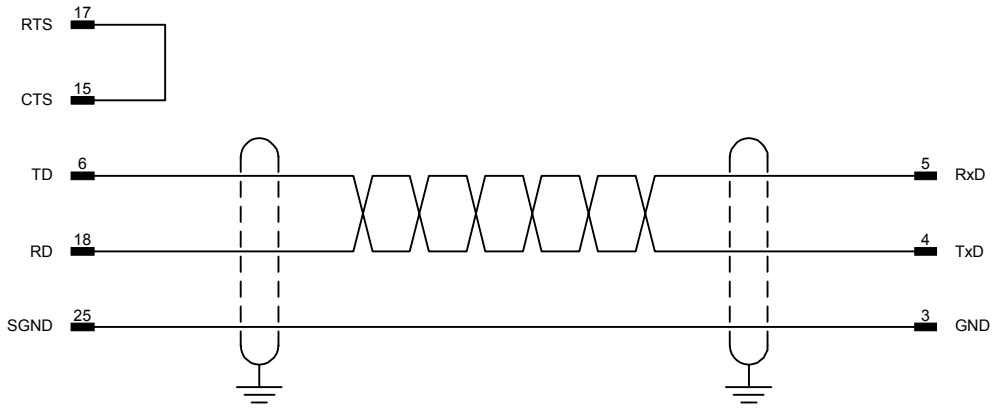
Both ends of the shield are connected to the metallic housing.

#### 5.3.2.3.5 Cable X3 SER1 RS232 - Schraml SPS FWM160

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Schraml
FWM160




D-SUB
male connector
25 pin

RJ45
connector
5 pin

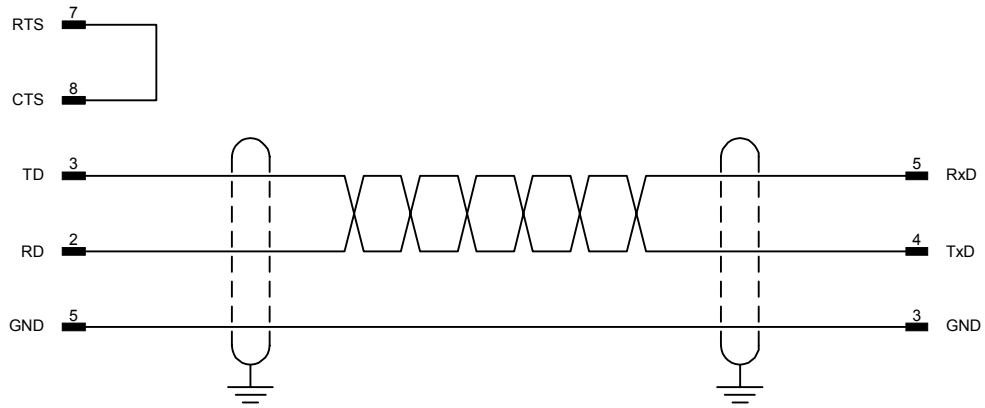
Both ends of the shield are connected to the metallic housing.

#### 5.3.2.3.6 Cable X2 RS232 - Schraml SPS FWM160

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Schraml
FWM160




D-SUB
male connector
9 pin

RJ45
connector
5 pin

Both ends of the shield are connected to the metallic housing.

### 5.3.3 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-52 Error messages for 3S serial

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | 03 | Framing error on serial interface | |
| | 05 | CRC error on serial interface | |
| | 06 | Parity error on serial interface | |
| 60 | 10 | Wrong telegram length | |
| | 20 | Wrong telegram Ident Number | |
| | 30 | Wrong block number | |
| | 40 | Wrong checksum | |
| | 50 | Negative acknowledgement | |
| | 60 | Waiting time exceeded: No response | Cable interruption, connection cut-off, wrong baud rate |
| 70 | | Error from the controller | |

## 5.3.4 Applications

### 5.3.4.1 CoDeSys Version 2.2 or Higher

The programming software takes the global variables from the symbol file project_name.SYM and inserts them into the variable list.

The symbolic names cannot be longer than 80 characters.

The entries in the variable list cannot be modified.

#### 5.3.4.1.1 Declaring Global Variables

To declare global variables in CoDeSys:

1. Select **Auto Declare** from the **Edit** menu.

The **Declare Variable** dialog opens.

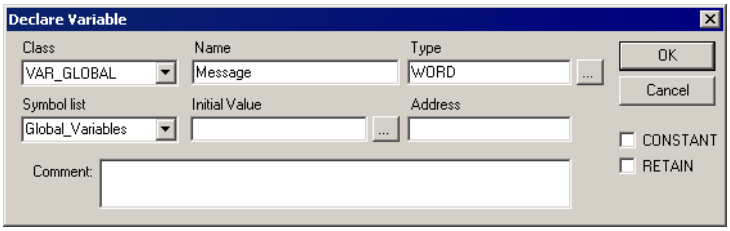



Figure 5-8 Example of a variable declaration for global variables

2. Select the VAR_GOBAL class from the **Class** field.
3. Enter a name (Message) and a type (WORD).
4. Repeat step 3 for all additional global variables.
5. Click **OK** to confirm your input.

The **Global_Variables** window opens.

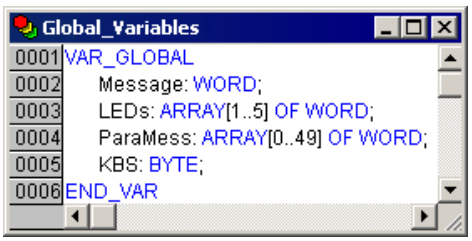



Figure 5-9 Window 'Global variables'

#### 5.3.4.1.2 Activate Output into Symbol File

Specify the following settings in CoDeSys to write the global variables into a symbolic file.

1. Select **Options** from the **Project** menu.
2. Select **Symbol configuration**.

The **Options** dialog will look as follows.

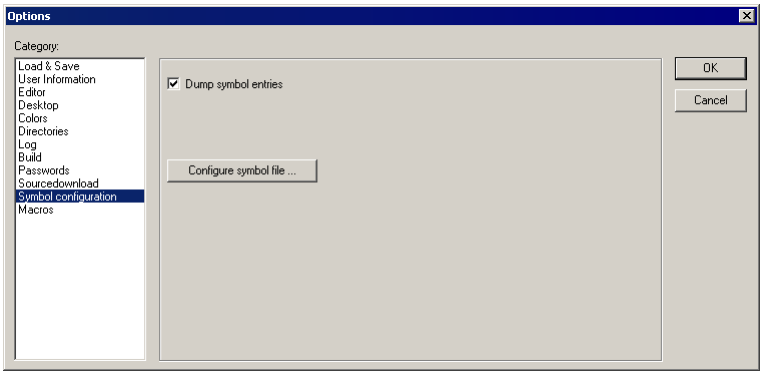



Figure 5-10 Dialog 'Options' - symbol configuration

3. Select the **Dump symbol entries** check box.
4. Click the **Configure symbol file** button.

The **Set object attributes** window opens.

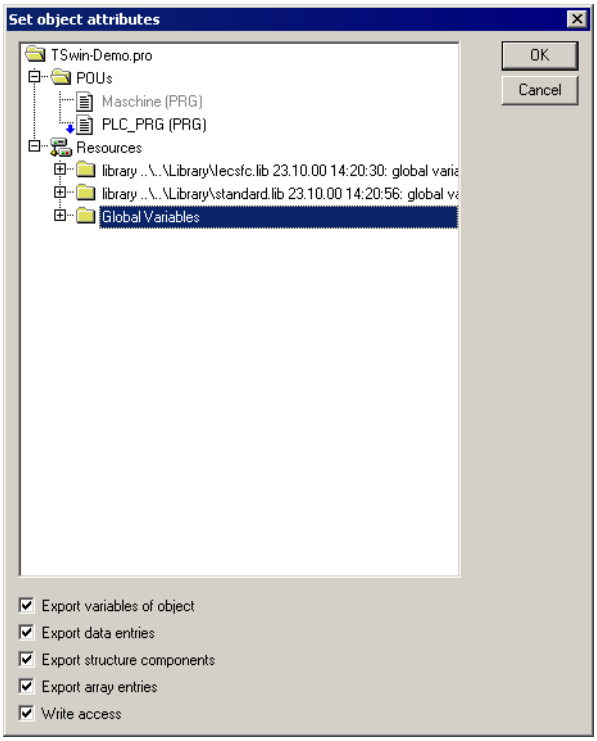



Figure 5-11 Dialog 'Set object attributes'

5. Select the **Global variables** entry.
6. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

Now you need to specify the position where the symbol file is to be stored.

1. Select **Directories** from the **Options** dialog.

The **Options** dialog will look as follows.

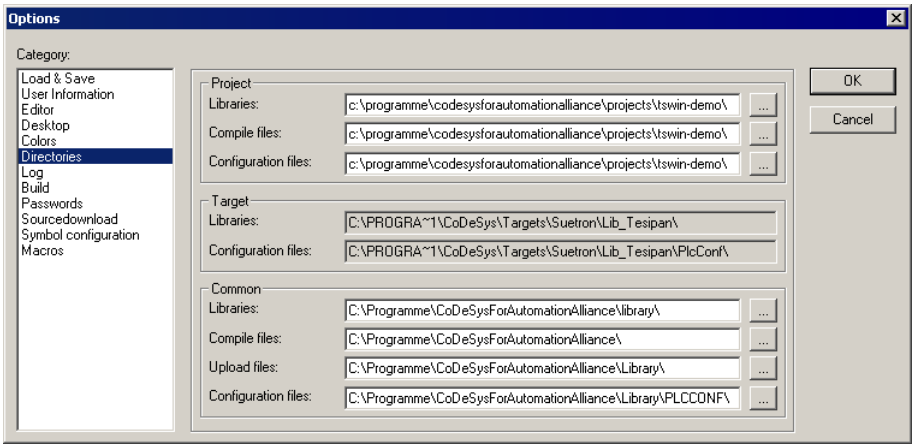



Figure 5-12 Dialog 'Options' - directories

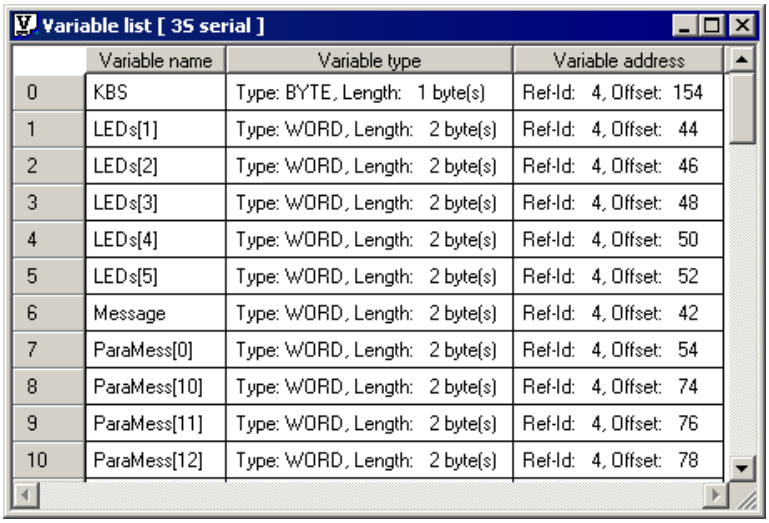
2. From the **Project** area, select a directory for the **compile files**.
3. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

The symbol file will not be created until a compilation process takes place and is stored in the same directory as the project!

#### 5.3.4.1.3 Variable List

The programming software automatically places the symbolic variable entries created in the example into the variable list if you specified the correct directory and name in the communications parameters.




| | Variable name | Variable type | Variable address |
|---|---|---|---|
| 0 | KBS | Type: BYTE, Length: 1 byte(s) | Ref-Id: 4, Offset: 154 |
| 1 | LEDs[1] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 44 |
| 2 | LEDs[2] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 46 |
| 3 | LEDs[3] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 48 |
| 4 | LEDs[4] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 50 |
| 5 | LEDs[5] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 52 |
| 6 | Message | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 42 |
| 7 | ParaMess[0] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 54 |
| 8 | ParaMess[10] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 74 |
| 9 | ParaMess[11] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 76 |
| 10 | ParaMess[12] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 78 |

Figure 5-13 Variable list

This makes the variables globally available in the programming software and allows them to be selected in the **Mask element Variable** dialog as controller variables.

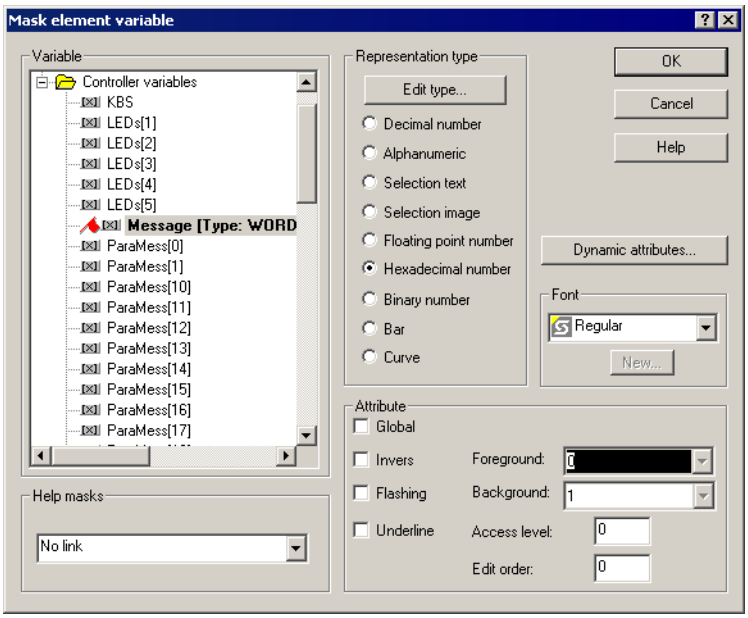



Figure 5-14 Dialog 'Mask element Variable'

## 5.4 3S Symbolic

The protocol provides random read and write access to all global data objects of the controller.

The programming software adopts the data objects of the project_name.SYM file which are created when the CoDeSys project is compiled.

The connected operating device uses the symbolic name to access a data object.

### 5.4.1 Data Types

The length of a variable is determined by the length defined in the programming software CoDeSys.

#### 5.4.1.1 Single Variables

You can access variables of the following type: BOOL, BYTE, WORD, DWORD, SINT, INT, DINT, USINT, UINT, UDINT, REAL, and STRING. Floating point numbers are interpreted in IEEE format. The variable type REAL is required for this purpose.

#### 5.4.1.2 String Variables

For string variables, the variable type STRING(N) is used, where N is the length of the string.

## 5.4.2 Programming

### 5.4.2.1 Protocol Parameters

#### 5.4.2.1.1 Baud rate

This parameter specifies the communication rate.

Table 5-53 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 4800 | |
| 9600 | |
| 19200 | |
| 38400 | X |

#### 5.4.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-54 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.4.2.1.3 Data Bits

This parameter specifies the number of data bits.

Table 5-55 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.4.2.1.4 Stop Bits

This parameter specifies the number of stop bits.

Table 5-56 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.4.2.1.5 Waiting Time for Response

This parameter specifies how long the operating device waits for a response from the PLC.

Table 5-57 Waiting Time for Response

| Configurable Values | Default Value |
|---|---|
| 100 ms to 25500 ms | 1000 ms |

#### 5.4.2.1.6 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-58 Delay until Connection Set-Up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.4.2.1.7 Byte Order

This parameter specifies the destination hardware's CPU type.

Table 5-59 Byte order

| Configurable Values | Default Value |
|---|---|
| Intel | |
| Motorola | X |

#### 5.4.2.1.8 Controllers

This parameter is reserved for future extensions.

Table 5-60 Controllers

| Configurable Values | Default Value |
|---|---|
| Standard | X |
| PLCWinNT | |

#### 5.4.2.1.9 Path for Variable List *.sym

This parameter specifies the directory in which the variable list *.sym is stored.

To select a directory, click the Browse button.

The variable list *.sym is created by the programming software **CoDeSys** when compilation takes place.

### 5.4.2.2 System Parameters

#### 5.4.2.2.1 Poll Area

The poll area is used to manage the write coordination byte, the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

This protocol requires you to set up the poll area with three single variables.

Table 5-61 Data types for the poll area

| Area | Valid Data Types |
|---|---|
| KBS (write coordination byte) | BYTE, USINT, WORD, UINT |
| Message Channel | WORD, UINT |
| Function Key LEDs | BYTE, USINT, WORD, UINT, DWORD, UDINT, ARRAY[1..N] |

#### 5.4.2.2.2 Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device. For status message addressing, use the data types BYTE, USINT, WORD, UINT, DWORD, UDINT, or ARRAY[1..N]. The following applies when using ARRAY: The type size multiplied by N provides the size of the message system in bytes.

#### 5.4.2.2.3 Date and Time

The variables for synchronizing the time and date must use the data types USINT or ARRAY [1..N] OF BYTE.

Table 5-62 Byte lengths for the date and time

| Variable | Length |
|---|---|
| Date with a 2-digit year | 3 Bytes |
| Date with a 4-digit year | 4 Bytes |
| Time | 3 Bytes |
| Weekday | 1 Byte |

### 5.4.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.4.3.1 Pin assignment for operating devices with a universal interface

Table 5-63 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.4.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-64 Pin assignment X2 RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

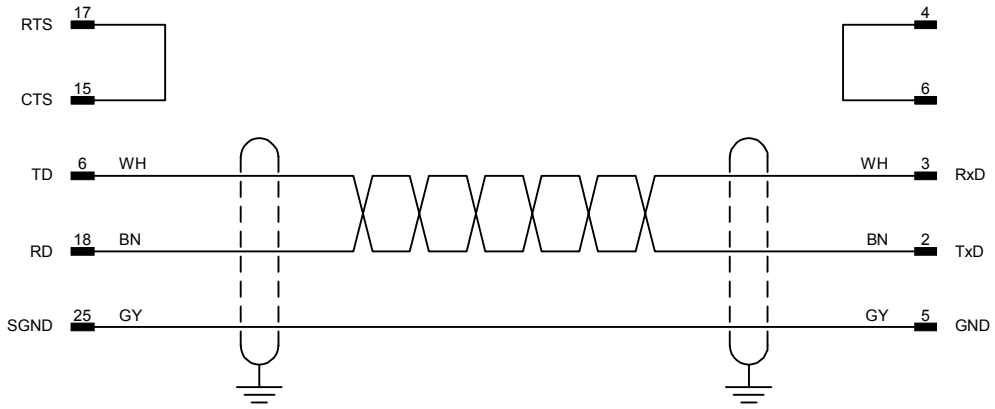
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.4.3.3 Cable X3 SER1 RS232 - Schraml PLC FWM105

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Schraml
FWM105




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

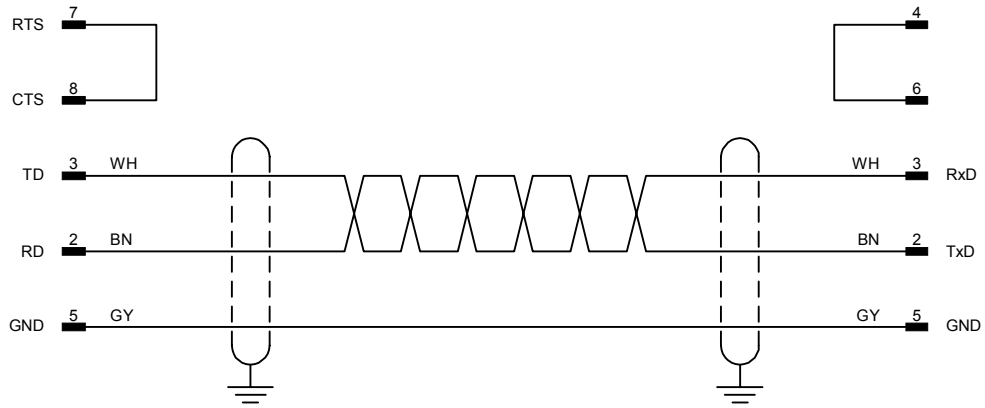
Both ends of the shield are connected to the metallic housing.

#### 5.4.3.4 Cable X2 RS232 - Schraml SPS FWM105

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Schraml
FWM105




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

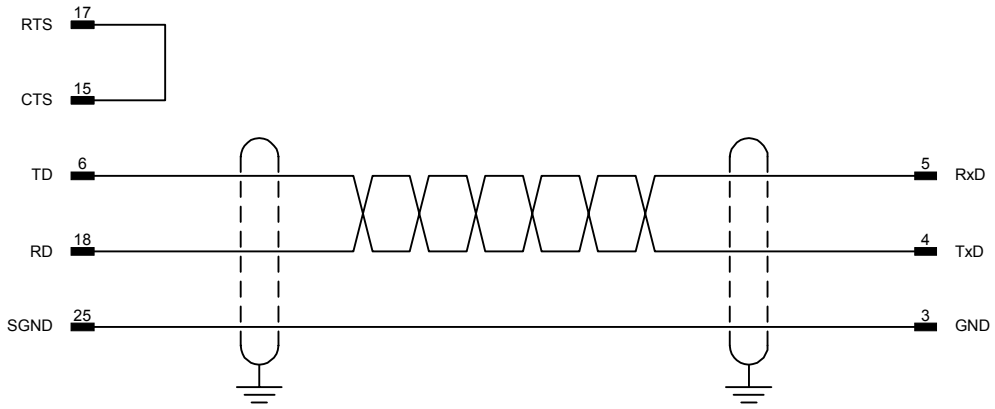
Both ends of the shield are connected to the metallic housing.

#### 5.4.3.5 Cable X3 SER1 RS232 - Schraml SPS FWM160

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Schraml
FWM160




D-SUB
male connector
25 pin

RJ45
connector
5 pin

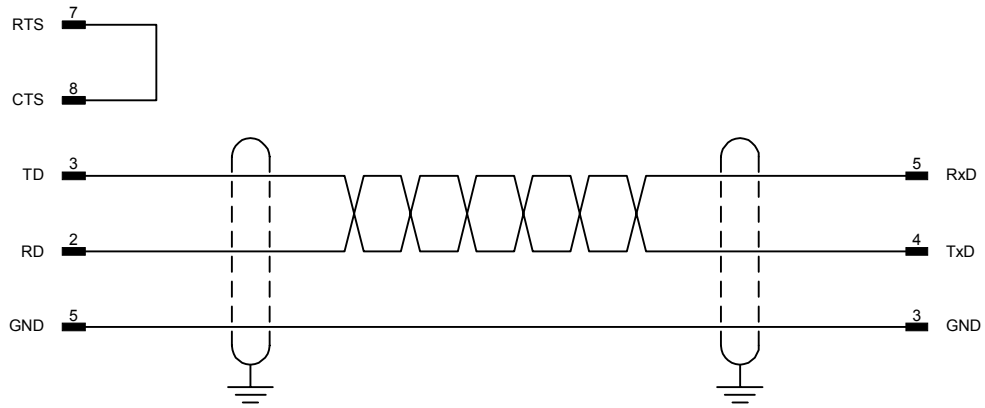
Both ends of the shield are connected to the metallic housing.

#### 5.4.3.6 Cable X2 RS232 - Schraml SPS FWM160

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Schraml
FWM160




D-SUB
male connector
9 pin

RJ45
connector
5 pin

Both ends of the shield are connected to the metallic housing.

### 5.4.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-65 Error messages for 3S symbolic

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | 03 | Framing error on serial interface | |
| | 05 | CRC error on serial interface | |
| | 06 | Parity error on serial interface | |
| | 10 | Poll area error | No poll area defined |
| 60 | 10 | Wrong telegram length | |
| | 20 | Wrong telegram Ident Number | |
| | 30 | Wrong block number | |
| | 40 | Wrong checksum | |
| | 50 | Negative acknowledgement | |
| | 60 | Waiting time exceeded: No response | Cable interruption, connection cut-off, wrong baud rate |
| 70 | | Error from controller | |
| | 50 | No service | Wrong service code |
| | 51 | No variable list | Variable list in controller is missing |
| 80 | 20 | Variable types not the same | Recompile the project using the current symbol file and reload it into the operating device. |
| | 30 | Invalid symbol | |
| | 40 | Waiting time exceeded | There is no valid symbol list in the controller.Specify a higher value for Delay until Connection Set-Up |

## 5.4.5 Applications

### 5.4.5.1 CoDeSys Version 2.2 or Higher

The programming software takes the global variables from the symbol file project_name.SYM and inserts them into the variable list.

The symbolic names cannot be longer than 80 characters.

The entries in the variable list cannot be modified.

#### 5.4.5.1.1 Declaring Global Variables

To declare global variables in CoDeSys:

1. Select **Auto Declare** from the **Edit** menu.

The **Declare Variable** dialog opens.

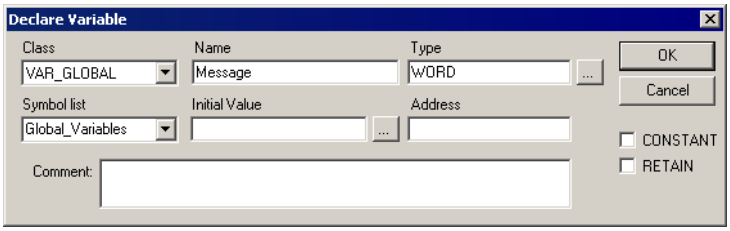



Figure 5-15 Example of a variable declaration for global variables

2. Select the VAR_GOBAL class from the **Class** field.
3. Enter a name (Message) and a type (WORD).
4. Repeat step 3 for all additional global variables.
5. Click **OK** to confirm your input.

The **Global_Variables** window opens.

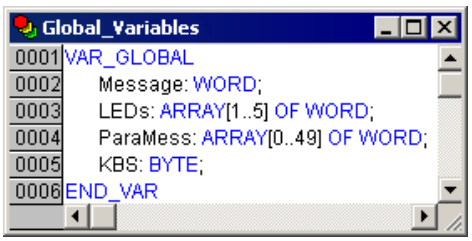



Figure 5-16 Window 'Global variables'

#### 5.4.5.1.2 Activate Output into Symbol File

Specify the following settings in CoDeSys to write the global variables into a symbolic file.

1. Select **Options** from the **Project** menu.
2. Select **Symbol configuration**.

The **Options** dialog will look as follows.

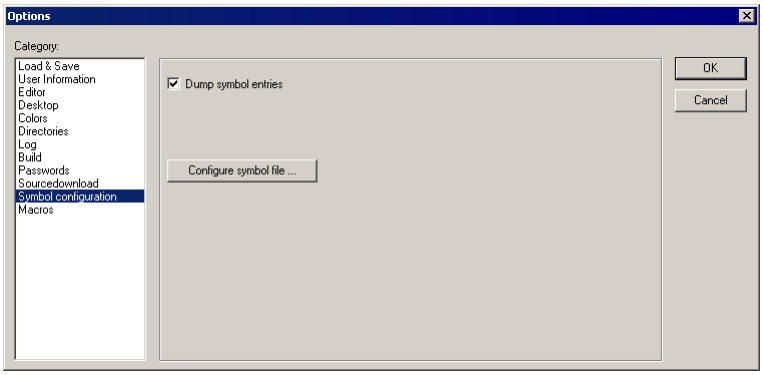



Figure 5-17 Dialog 'Options' - symbol configuration

3. Select the **Dump symbol entries** check box.
4. Click the **Configure symbol file** button.

The **Set object attributes** window opens.

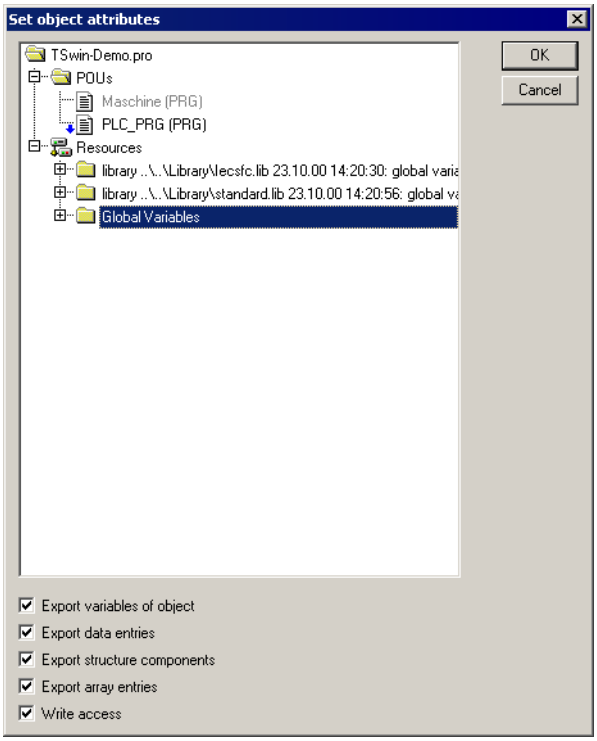



Figure 5-18 Dialog 'Set object attributes'

5. Select the **Global variables** entry.
6. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

Now you need to specify the position where the symbol file is to be stored.

1. Select **Directories** from the **Options** dialog.

The **Options** dialog will look as follows.

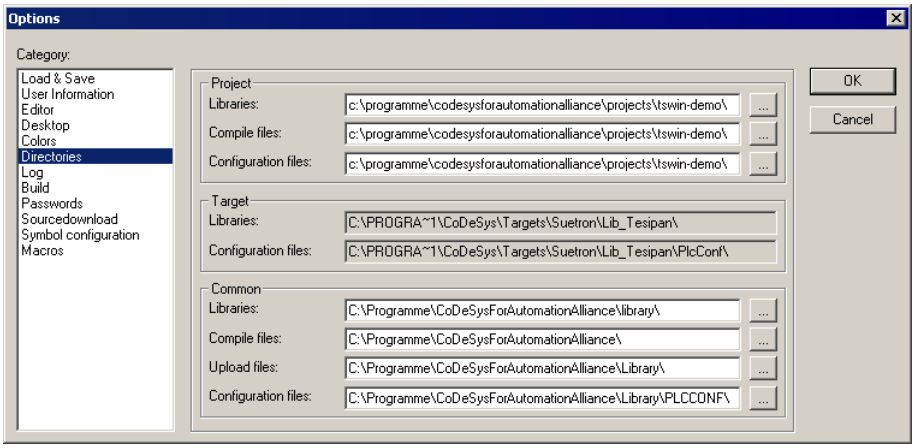



Figure 5-19 Dialog 'Options' - directories

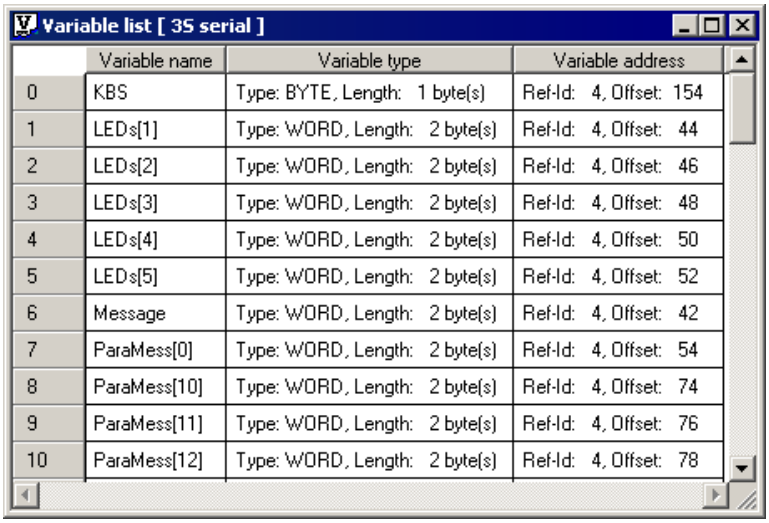
2. From the **Project** area, select a directory for the **compile files**.
3. Click **OK** to confirm your selection.

You are returned to the **Options** dialog.

The symbol file will not be created until a compilation process takes place and is stored in the same directory as the project!

#### 5.4.5.1.3 Variable List

The programming software automatically places the symbolic variable entries created in the example into the variable list if you specified the correct directory and name in the communications parameters.




| | Variable name | Variable type | Variable address |
|---|---|---|---|
| 0 | KBS | Type: BYTE, Length: 1 byte(s) | Ref-Id: 4, Offset: 154 |
| 1 | LEDs[1] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 44 |
| 2 | LEDs[2] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 46 |
| 3 | LEDs[3] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 48 |
| 4 | LEDs[4] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 50 |
| 5 | LEDs[5] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 52 |
| 6 | Message | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 42 |
| 7 | ParaMess[0] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 54 |
| 8 | ParaMess[10] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 74 |
| 9 | ParaMess[11] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 76 |
| 10 | ParaMess[12] | Type: WORD, Length: 2 byte(s) | Ref-Id: 4, Offset: 78 |

Figure 5-20 Variable list

This makes the variables globally available in the programming software and allows them to be selected in the **Mask element Variable** dialog as controller variables.

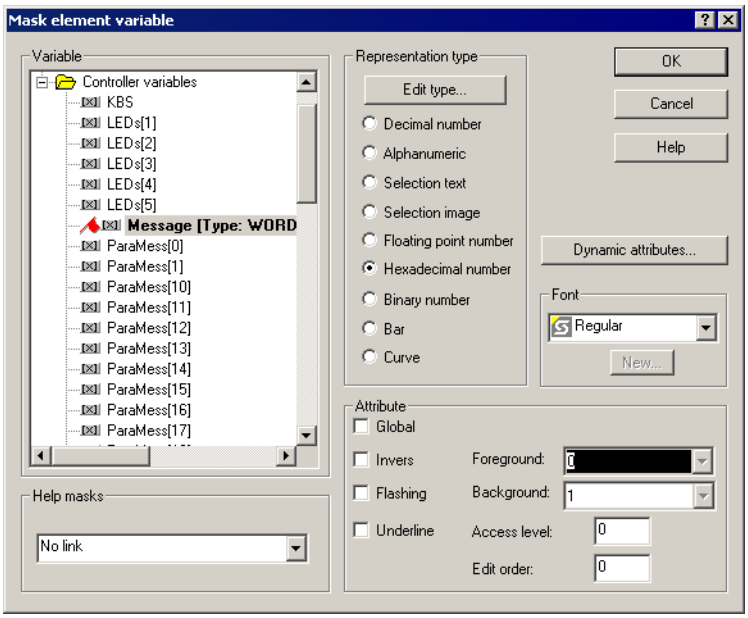



Figure 5-21 Dialog 'Mask element Variable'

## 5.5 ABB Arcnet

With its multi-master capabilities, the Arcnet/Modbus protocol can be used for communication between one or more operating devices with up to 255 controllers. The operating device can only ever communicate with one controller at a time, because of the “Passing Token“ access control. During this process, the operating device always acts as the master. In a bus system comprising several masters, the token is passed to the next master once a communication request has been processed. You can log on and log off network participants while the network is running.

New participants are added to the bus system by reconfiguring the network. During this process, the node number which is stored in a register of the Arcnet controller is transferred.

### 5.5.1 Hardware

TesiMod operating devices are connected to Arcnet either by means of a BNC connector and coaxial cable or a RJ45 connector and twisted pair cable. The signal types and line codes are identical in both cases. This means that you can use a mix of these methods within a network. Bus, star or tree network structures or any combination of these topologies are possible. The end points of a network must be terminated with a terminating resistor. The network structure can be expanded with the use of (active) hubs.

### 5.5.2 Telegram Setup

With the Arcnet protocol, data packets with a total length of 256 bytes (including telegram header) are transmitted. Larger volumes of data are fragmented and then transmitted.

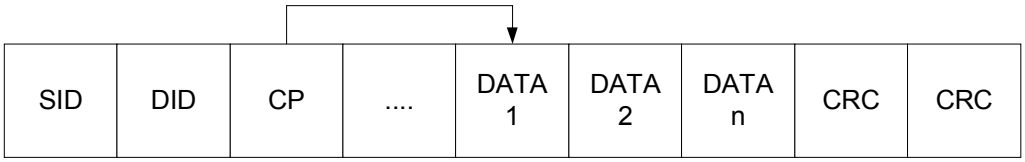



Figure 5-22 Arcnet telegram setup

The Arcnet data frame incorporates the Modbus protocol for the purposes of interpreting and evaluating data. The access modes (read or write) of different data types (bit, word or double-word) are differentiated using function codes.

See chapter “Data Types“ on page 5-80.

The Modbus part of the telegram contains the slave number, function codes, addresses, number of user data and the CRC check sum.

Figure 5-23 Modbus telegram in the Arcnet data frame

**Example:** Master reads MD 00,02 = 32D; MD 00,13 = 80000D from slave 2Source address MD 00,02 : 4002H = 16386DThe read data are stored starting from MW 10,01 (target address).

Table 5-66 Modbus query by master (operating device)

| Slave No. | FCT | Address High | Address Low | Number of Words High | Number of Words Low | CRC High | CRC Low |
|---|---|---|---|---|---|---|---|
| 02h | 03h | 40h | 02h | 00h | 04h | F0h | 09h |

Table 5-67 Modbus response by slave (controller)

| Slave No. | FCT | Number of Bytes | Data 1 High | Data 1 Low | Data 2 High | Data 2 Low | Data 3 High | Data 3 Low | Data 4 High | Data 4 Low | CRC High | CRC Low |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 02h | 03h | 08h | 00h | 00h | 00h | 20h | 00h | 01h | 38h | 80h | 57h | 80h |

## 5.5.3 Data Types

The following data types are available for direct access.

Bit, word and double-word accesses are possible (read and write accesses).

The address areas are controller-specific. In case of the PLC ABB 07KT94, the bit, word and double-word addresses are located in different memory areas. They are distinguished during addressing by specifying the identifier M (flag), MW (flag word) and MD (flag double-word).

Table 5-68 Data Types

| Modbus Address Hexadecimal | FCT read | FCT write | PLC Address | Meaning |
|---|---|---|---|---|
| 0000 to 03FF | 1, 2 | 5, 15 | E 00,00 to E 63,15 | Input binary |
| 1000 to 13FF | 1, 2 | 5, 15 | A 00,00 to A 63,15 | Output binary |
| 2000 to 2FF | 1, 2 | 5, 15 | M 00,00 to M 255,15 | Flag binary |
| 3000 to 30FF | 1, 2 | 5 | S 00,00 to S 15,15 | Step sequence |
| 0000 to 007F | 3, 4 | 6, 16 | EW 00,00 to EW 07,15 | Input Word |
| 1000 to 107F | 3, 4 | 6, 16 | AW 00,00 to AW 07,15 | Output Word |
| 2000 to 2FFF | 3, 4 | 6, 16 | MW 00,00 to MW 255,15 | Flag Word |

Table 5-68 Data Types

| Modbus Address Hexadecimal | FCT read | FCT write | PLC Address | Meaning |
|---|---|---|---|---|
| 3000 to 327F | 3, 4 | | KW 00,00 to KW 39,15 | Constant Word |
| 4000 to 41FF | 3, 4 | 16 | MD 00,00 to MD 31,15 | Flag Double-Word |
| 5000 to 507F | 3, 4 | | KD 00,00 to KD 07,15 | Constant Double-Word |

## 5.5.4 Programming

### 5.5.4.1 Protocol Parameters

#### 5.5.4.1.1 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-69 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 1000 ms |

#### 5.5.4.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-70 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1000 ms to 25000 ms | 5000 ms |

#### 5.5.4.1.3 Baud Rate

The Arcnet protocol is optimized for the ABB PLC 07KT94. This PLC uses a baud rate of 2.5 MBaud. This is a fixed baud rate setting.

#### 5.5.4.1.4 Node Address

Use the node address parameter to address the operating device in the network. Each node number must only appear once.

Table 5-71 Node address

| Configurable Values | Default Value |
|---|---|
| 1 to 255 | 1 |

If you assign a node address different from 1 for the operating device, you must implement changes in the PLC function protocol:

- Enter the new Arcnet address for the operating device in the AREC block at the NO input (linked with ZUDKW) and #JO input .
- In the ASEND block, enter the new Arcnet address of the operating device at the NO input (linked with ZUDKW) and #J input.

If, on the other hand, you want several operating devices and ABB controllers to communicate within a network, you must adjust the controller function protocol accordingly. This option is supported by the operating device driver and TSwin.

In the function protocol, you must add the same number of AREC and ASEND blocks as the number of masters to be programmed. Each master (operating device) is identified by a separate job number which it uses to issue order telegrams and receive reply telegrams. The job number for the job programmed on this block is specified at input #JO . You must apply the same settings to the ASEND block.

#### 5.5.4.1.5 Maximum Number of Nodes

You can use this parameter to specify the maximum number of participants on the network. Note that this value influences the communication rate.

Table 5-72 Maximum number of nodes

| Configurable Values | Default value |
|---|---|
| 1 to 255 | 255 |

Table 5-73 Number of nodes and timeout value

| Number of Nodes | Timeout Value in ms |
|---|---|
| up to 255 | 420 |
| up to 64 | 105 |
| up to 32 | 52,5 |
| up to 16 | 26,25 |

#### 5.5.4.1.6 Initializing Values for Timer

This parameter influences the communication rate. The values for Response Time, Idle Time and Reconfiguration Time are all interdependent and can not be set without reference to one another. The higher the values selected, the broader the network can be.

Table 5-74 Initializing values for timer

| Configurable Values | | Default Value |
|---|---|---|
| Response Time | 596 µs | |
| | 298 µs | |
| | 150 µs | |
| | 37.4 µs | X |
| Idle Time | 656 µs | |
| | 328 µs | |
| | 164 µs | |
| | 41 µs | X |
| Reconfiguration Time | 840 ms | |
| | 840 ms | |
| | 840 ms | |
| | 420 ms | X |

#### 5.5.4.1.7 Modbus Parameters

Using function codes, select the valid addressing options for your controller. However, you should keep the standard settings for the ABB 07KT94 controller.

#### 5.5.4.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

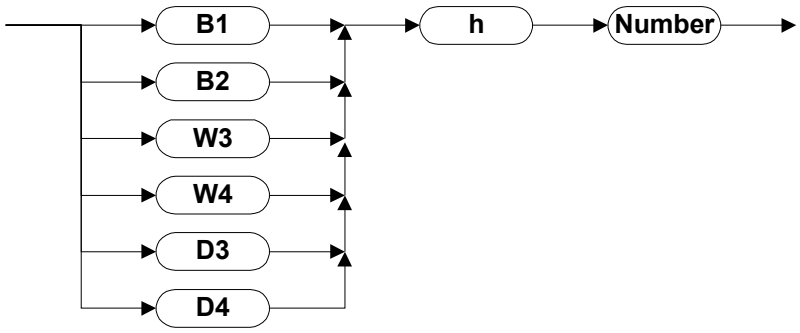



Figure 5-24 Syntax diagram

To avoid communication errors, bear the following points in mind:

– Do not program a word access to a double-word address. This generates error code 70 with subcode 71.
– Do not program a double-word access to a word address.
– If there is no support for read-only function codes, you must adjust the field type for display in the programming software to “output“.

See chapter “Error Messages“ on page 5-90.

Example for a variable of the type "Flag Word" for a read and write access:

| | | | | |
|---|---|---|---|---|
| MW 00,00 | = | 2000h | | |
| Offset decimal | = | 220 x 16 | = | 3520 |
| Offset hex | = | DCh x 10h | = | DC0h |
| Address | = | 2000h + DC0h | = | 2DC0h |

##### 5.5.4.2.1 Syntax for Inputs

Table 5-75 Variable syntax for inputs

| Variable type | FCT read | FCT write | Address | Slave No. |
|---|---|---|---|---|
| B1<br>Read/write bit | 1 | 5, 15 | B1 h0000 - 03FF | 2 |
| B2<br>Only read bit | 1, 2 | | B2 h0000 - 03FF | 2 |
| W3<br>Read/write word | 3 | 6, 16 | W3 h0000 - 007F | 2 |
| W4<br>Only read word | 3, 4 | | W4 h0000 - 007F | 2 |

#### 5.5.4.2.2 Syntax for Outputs

Table 5-76 Variable syntax for outputs

| Variable type | FCT read | FCT write | Address | Slave No. |
|---|---|---|---|---|
| B1<br>Read/write bit | 1 | 5, 15 | B1 h1000 - 13FF | 2 |
| B2<br>Only read bit | 1, 2 | | B2 h1000 - 13FF | 2 |
| W3<br>Read/write word | 3 | 6, 16 | W3 h1000 - 107F | 2 |
| W4<br>Only read word | 3, 4 | | W4 h1000 - 107F | 2 |

#### 5.5.4.2.3 Syntax for Flag Area

Table 5-77 Variable syntax for flag area

| Variable type | FCT read | FCT write | Address | Slave No. |
|---|---|---|---|---|
| B1<br>Read/write bit | 1 | 5, 15 | B1 h2000 - 2FFF | 2 |
| B2<br>Only read bit | 1, 2 | | B2 h2000 - 2FFF | 2 |
| W3<br>Read/write word | 3 | 6, 16 | W3 h2000 - 2FFF | 2 |
| W4<br>Only read word | 3, 4 | | W4 h2000 - 2FFF | 2 |
| D3<br>Read/write double-word | 3 | 6, 16 | D3 h4000 - 41FF | 2 |
| D4<br>Only read double-word | 3, 16 | | D4 h4000 - 41FF | 2 |

#### 5.5.4.2.4 Syntax for Constants

Table 5-78 Variable syntax for constants

| Variable type | FCT read | FCT write | Address | Slave No. |
|---|---|---|---|---|
| W3<br>Read/write word | 3 | 5, 15 | W3 h3000 - 327F | 2 |
| W4<br>Only read word | 3, 4 | | W4 h3000 - 327F | 2 |
| D3<br>Read/write double-word | 3 | 6, 16 | D3 h5000 - 507F | 2 |
| D4<br>Only read double-word | 4, 16 | | D4 h5000 - 507F | 2 |

#### 5.5.4.2.5 Syntax for Step Sequence

Table 5-79 Variable syntax for step sequence

| Variable type | FCT read | FCT write | Address | Slave No. |
|---|---|---|---|---|
| B1<br>Read/write bit | 1 | 5, 15 | B1 h3000 - 30FF | 2 |
| B1<br>Only read bit | 1, 2 | | B1 h3000 - 30FF | 2 |

### 5.5.4.3 System Parameters

#### 5.5.4.3.1 Poll Area

The polling area must be located within the flag word area.

Table 5-80 Word-oriented polling area

| Word Address | Refe-rence | High Byte | Low Byte |
|---|---|---|---|
| Word address<br>+ 0 | W3<br>H2000 | Write<br>coordination byte | Reserved |
| Word address<br>+ 1 | W3<br>H2001 | Message channel<br>high byte | Message channel<br>low byte |
| Word address<br>+ 2 | W3<br>H2002 | Function key LED<br>1 to 4 | Function key LED<br>5 to 8 |
| Word address<br>+ 3 | W3<br>H2003 | Function key LED<br>9 to 12 | Function key LED<br>13 to 16 |
| Word address<br>+ 4 | W3<br>H2004 | Function key LED<br>17 to 20 | Function key LED<br>21 to 24 |
| Word address<br>+ 5 | W3<br>H2005 | Function key LED<br>25 to 28 | Function key LED<br>29 to 32 |

#### 5.5.4.3.2 Status Messages

The parallel message system must be located within the data word area.

Table 5-81 Parallel message system

| Word Address | Refe-rence | High Byte | Low Byte |
|---|---|---|---|
| Word address<br>+ 0 | W3<br>H2010 | Messages 9 to 15 | Messages 0 to 8 |
| Word address<br>+ 1 | W3<br>H2011 | Messages 24 to 31 | Messages 16 to 23 |
| Word address<br>+ 2 | W3<br>H2012 | Messages 40 to 47 | Messages 32 to 39 |

#### 5.5.4.3.3 Internally used flag addresses

The addresses of internally used flags are not available to the user for programming.

Table 5-82 Internally used flag addresses

| Flag Variable | PLC Address | Reference |
|---|---|---|
| M 250,00 to 250,05 | 2F91 to 2F96 | Flag, binary |
| M 251,14 to 251,15 | 2FAF to 2FB0 | Flag, binary |
| MW 220,00 to 224,01 | 2DB1 to 2DF2 | Flag word |
| MW 228,00 to 231,15 | 2E31 to 2E70 | Flag word |
| MW 250,00 to 250,05 | 2F91 to 2F96 | Flag word |
| A 62,00 to 62,01 | 13 D1 to 13D2 | Output, binary |
| KW 01,00 to 01,01 | 3091 | Constant word |
| KW 01,00 to 01,01 | 3011 to 3012 | Constant word |
| K 00,00 to 00,01 | | |

### 5.5.5 Physical Interfacing

You can use both coaxial cables and twisted-pair cables to connect with Arcnet. Arcnet nodes can be connected to produce bus, star and tree topologies. Hubs (active or passive) are required to create star-type network structures and expansions. You must always terminate the end points of the network structure with terminating resistors.

In the case of twisted-pair networks, twisted pair cables with an impedance of 120 Ohm and a shielding are used.

For coaxial networks, we recommend the use of type RG62 coaxial cables with an impedance of 93 Ohm.

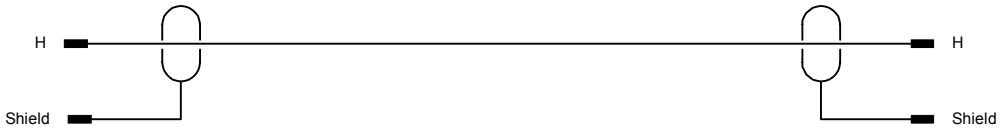
For a bus network segment with eight participants, the maximum length is 300 m (984.252 feet). If the network is small, you can increase the number of participants. You can extend each end of a network segment with an active hub. This allows a total expansion of 6 km (3.728 miles) and a maximum number of 255 participants.

Table 5-83 Pin assignment for RJ45 female connector

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not connected |
| 2 | nc | Not connected |
| 3 | nc | Not connected |
| 4 | Line+ | Data Signal + |
| 5 | Line- | Data Signal - |
| 6 | nc | Not connected |
| 7 | nc | Not connected |
| 8 | nc | Not connected |

#### 5.5.5.1 Cable for Arcnet with BNC Connectors

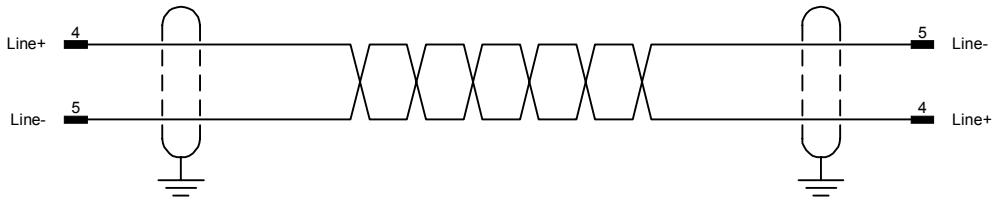
Operating device | Controller




BNC connector | BNC connector

#### 5.5.5.2 Cable for Arcnet with RJ45 Connector

Operating device | Controller




RJ45 Modular Jack Connector 8 pin | RJ45 Modular Jack Connector 8 pin

### 5.5.6 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-84 Error messages for ABB Arcnet

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Communication error on the Arcnet protocol level | |
| | 08 | The communication partner keeps returning NAKs during connection setup | |
| | 09 | Packet length not permitted | |
| | 10 | Transmitter not enabled, no transmission possible | |
| 51 | | Error initializing Arcnet controller | |
| 60 | | Communication error on hardware level | |
| | 05 | Wrong checksum | |
| | 10 | No cyclic data defined | |
| 70 | | Communication error on the MODBUS protocol level | |
| | 60 | No response from PLC | |
| | 68 | Incorrect number of data received | |
| | 71 | Access with a word variable to a double-word address | |
| 80 | | Unexpected communication reply from PLC | |
| 90 | | Code for sending another telegram; internally only | |

## 5.6 ABB CS31

The ABB CS31 protocol allows you random read and write access to all data of the controller.

The protocol supports a connection to all controllers of the CS31 series.

### 5.6.1 Data Types

Direct access is possible to the following data types.

Table 5-85 Data types - ABB CS31

| Type | Mnemonic | Access |
|---|---|---|
| Input | E | Bit Access |
| | EW | Word Access |
| Output | A | Byte Access |
| | AW | Word Access |
| Flag | M | Bit Access |
| | MW | Word Access |
| | MD | Double-Word Access |
| Register | KW | Word Access |
| | KD | Double-Word Access |

Variables of the same type located in a contiguous data block of up to 50 bytes are read as a block.

If the operating device accesses the binary inputs E62.00 to E63.07 and the analog inputs EW06.00 to EW06.03, the controller can only supply correct data if the controller has accessed an input of the corresponding group at least once.

## 5.6.2 Programming

### 5.6.2.1 Protocol Parameters

#### 5.6.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-86 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.6.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-87 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.6.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-88 Handshake

| Configurable Values | Default Value |
|---|---|
| No Handshake | |
| Hardware | X |
| Software | |

#### 5.6.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-89 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.6.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-90 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.6.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-91 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 1 ms to 65535 ms | 1000 ms |

#### 5.6.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-92 Delay until connection setup

| Configurable Values | Default Value |
|---|---|
| 100 ms to 25500 ms | 5000 ms |

#### 5.6.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

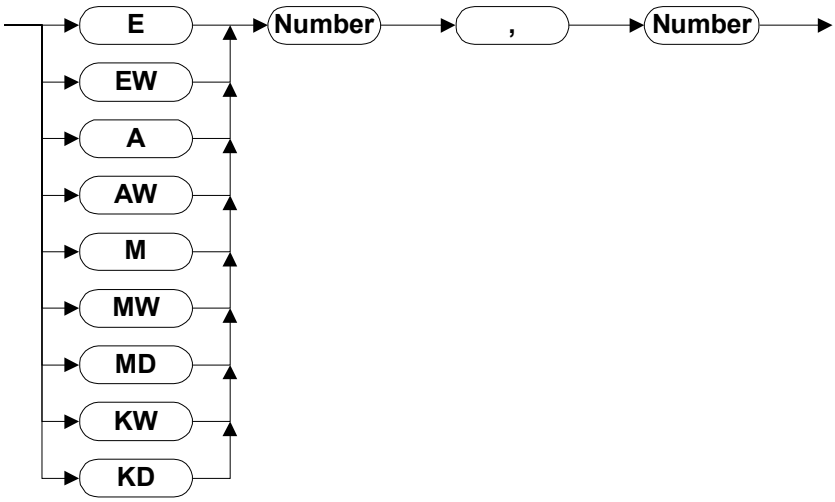



Figure 5-25 Syntax diagram for ABB CS31

#### 5.6.2.3 System Parameters

##### 5.6.2.3.1 Poll Area

For the address of the poll area, you must specify a flag word address.

Table 5-93 Word-oriented poll area - ABB CS31

| Word address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word address + 0 | MW000,10 | Write coordination byte | Reserved |
| Word address + 1 | MW000,11 | Message channel high-byte | Message channel low-byte |
| Word address + 2 | MW000,12 | Function key LED 1 to 4 | Function key LED 5 to 8 |
| Word address + 3 | MW000,13 | Function key LED 9 to 12 | Function key LED 13 to 16 |
| Word address + 4 | MW000,14 | Function key LED 17 to 20 | Function key LED 21 to 24 |
| Word address + 5 | MW000,15 | Function key LED 25 to 28 | Function key LED 29 to 32 |

If you want the LED of the function key F1 to be activated, write the value -32768 (0x8000h) to the address +2. This value will, however, not be transferred by the AS-CII protocol !

Instead of the value -32768, write the value -32767 (0x8001h) to the address +2. This sets the flashing bit for the LED of the function key F8. Setting the flashing bit only has an impact when the LED of function key F8 is already lit.

#### 5.6.2.3.2 Status Messages

For the address of the parallel message system, you must specify a flag word address.

Table 5-94 Parallel message system - ABB CS31

| Word address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word address + 0 | MW000,20 | Messages 9 to 15 | Messages 0 to 8 |
| Word address + 1 | MW000,21 | Messages 24 to 31 | Messages 16 to 23 |
| Word address + 2 | MW000,22 | Messages 40 to 47 | Messages 32 to 39 |

## 5.6.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.6.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-95 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.6.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-96 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.6.3.3 Cable X2 RS232 - ABB CS31

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device — ABB PLC CS31

D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

#### 5.6.3.4 Cable X3 SER1 RS232 - ABB CS31

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device — ABB PLC CS31

D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

### 5.6.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-97 ABB CS31 error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 1 | Slave not ready | |
| | 2 | Packets out of sequence | |
| | 3 | Error in protocol frame | |
| | 4 | Waiting time elapsed (timeout) | Connection broken. |
| | 5 | CRC error | |
| | 6 | Wrong parity | |
| | 7 | Send process aborted | |
| | 8 | Receive process aborted | |
| | 9 | Cyclic buffer overrun | Cyclic buffer too small |
| | 10 | No cyclic data defined | |
| | 12 | Cyclic data already defined | |
| | 15 | Protocol error | The selected protocol is not supported. |
| | 16 | Receive buffer overrun | |
| | 40 | System variable error | Undefined system variable |
| | 50 | Controller does not respond | |
| 2 | 52 | Incorrect number of data received | Check if the mask, in which the error occurred, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| | 54 | Received echo and transmitted data do not match. | |
| | 70 | Unknown error from controller | |
| | 71 | Wrong value | |
| | 72 | Wrong input | |
| | 73 | Number too large | |

## 5.7 ABB T200

The ABB T200 protocol allows you random read and write access to all data of the controller.

The protocol supports a connection to all controllers of the T200 series via the programming interface or a communication module.

You can establish

– a point-to-point connection (1:1) using the programming interface
– a multipoint connection (1:N) using a communication module.

The “One-Way-Activation-Procedure” which is based on the “Communication Protocol” is used for the communication. This protocol works on the master/slave principle. Here, the TesiMod operating device is the master and the controller functions as the slave.

### 5.7.1 Data Types

Direct access is possible to the following data types.

Table 5-98 Data types - ABB T200

| Type | Mnemonic | Address | Access |
|---|---|---|---|
| Input | E | Bit | Read/Write |
| | EW | Word | |
| | ED | Double word | |
| | E’ | Coupler bit | |
| | EW’ | Coupler word | |
| | ED’ | Coupler double-word | |
| Output | A | Bit | |
| | AW | Word | |
| | AD | Double word | |
| | A’ | Coupler bit | |
| | AW’ | Coupler word | |
| | AD’ | Coupler double-word | |
| Flag | M | Bit | |
| | MW | Word | |
| | MD | Double word | |
| | M’ | Bit from bit/word area | |
| | MW’ | Word from bit/word area | |
| | MD’ | Double word from bit/ word area | |

Table 5-98 Data types - ABB T200

| Type | Mnemonic | Address | Access |
|---|---|---|---|
| Timer | T | Status | Read-only |
| | TI | Actual value | |
| Counter | Z | Status | |
| | ZI | Actual value | |

#### 5.7.1.1 Value Ranges for the Data Types

Table 5-99 Value ranges for the data types

| Data type | Range of Values | Special features |
|---|---|---|
| Bit | 00 to 01 | None |
| Word | 0x7FF to 0x8001 | The value 0x8000 is not permitted. |
| Double word | 0x7FFFFFFF to 0x80000001 | The value 0x80000000 is not permitted. |

## 5.7.2 Programming

### 5.7.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.7.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-100 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.7.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-101 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.7.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-102 Handshake

| Configurable Values | Default Value |
|---|---|
| No Handshake | |
| Hardware | X |
| Software | |

#### 5.7.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-103 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

#### 5.7.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-104 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.7.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-105 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 1 ms to 65535 ms | 1000 ms |

#### 5.7.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-106 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 100 ms to 25500 ms | 5000 ms |

#### 5.7.2.1.8 Additional Parameters

In the TSwin variable list, use the slave number to assign each variable a network address. This address is used to exchange data between the operating device and the controller. This requires that you specify the necessary information for each slave number under the additional parameters.

Table 5-107 Assignment of slave number to office number and L.U.M.P.

| Slave No. | Office No. | L. | U. | M. | P. |
|---|---|---|---|---|---|
| 1 | 0 | 255 | 255 | 0 | 0 |
| 2 | 0 | 255 | 255 | 0 | 0 |
| 3 | 0 | 255 | 255 | 0 | 0 |
| 4 | 0 | 255 | 255 | 0 | 0 |
| 5 | 0 | 255 | 255 | 0 | 0 |
| 6 | 0 | 255 | 255 | 0 | 0 |
| 7 | 0 | 255 | 255 | 0 | 0 |
| 8 | 0 | 255 | 255 | 0 | 0 |

#### 5.7.2.1.9 1:N Communication

This parameter specifies whether you are using a multipoint connection.For a multi-point connection, you need to specify the office numbers.

Table 5-108 1:N communication

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.7.2.1.10 Access Authorization Control

This parameter specifies whether your are implementing the access authorization control function. For a multipoint connection with more than four devices, the access authorization control must be used.

Table 5-109 Access authorization control

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.7.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

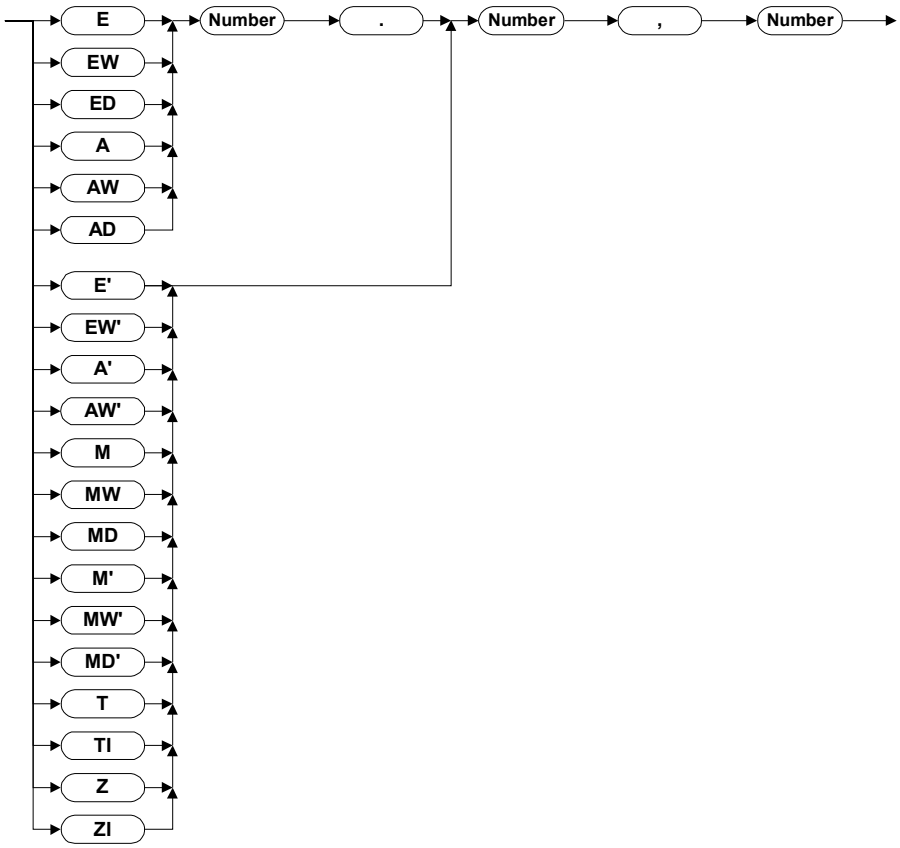



Figure 5-26 Syntax diagram

#### 5.7.2.3 System Parameters

##### 5.7.2.3.1 Poll Area

For the address of the poll area, you must specify a flag word address.

Table 5-110 Word-oriented poll area - ABB T200

| Word address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word address + 0 | MW'000,10 | Write coordination byte | Reserved |
| Word address + 1 | MW'000,11 | Message channel high-byte | Message channel low-byte |
| Word address + 2 | MW'000,12 | Function key LED 1 to 4 | Function key LED 5 to 8 |
| Word address + 3 | MW'000,13 | Function key LED 9 to 12 | Function key LED 13 to 16 |
| Word address + 4 | MW'000,14 | Function key LED 17 to 20 | Function key LED 21 to 24 |
| Word address + 5 | MW'000,15 | Function key LED 25 to 28 | Function key LED 29 to 32 |

If you want the LED of the function key F1 to be activated, write the value -32768 (0x8000h) to the address +2. This value will, however, not be transferred by the AS-CII protocol !

Instead of the value -32768, write the value -32767 (0x8001h) to the address +2. This sets the flashing bit for the LED of the function key F8. However, it only has an impact on the output if the LED of the function key F8 is to light up also.

#### 5.7.2.4 Status Messages

For the address of the parallel message system, you must specify a flag word address.

Table 5-111 Parallel message system - ABB T200

| Word address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word address + 0 | MW'000,20 | Messages 9 to 15 | Messages 0 to 8 |
| Word address + 1 | MW'000,21 | Messages 24 to 31 | Messages 16 to 23 |
| Word address + 2 | MW'000,22 | Messages 40 to 47 | Messages 32 to 39 |

### 5.7.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.7.3.1 Pin assignment for operating devices with a universal interface

Table 5-112 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Table 5-113 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.7.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-114 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

Table 5-115 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

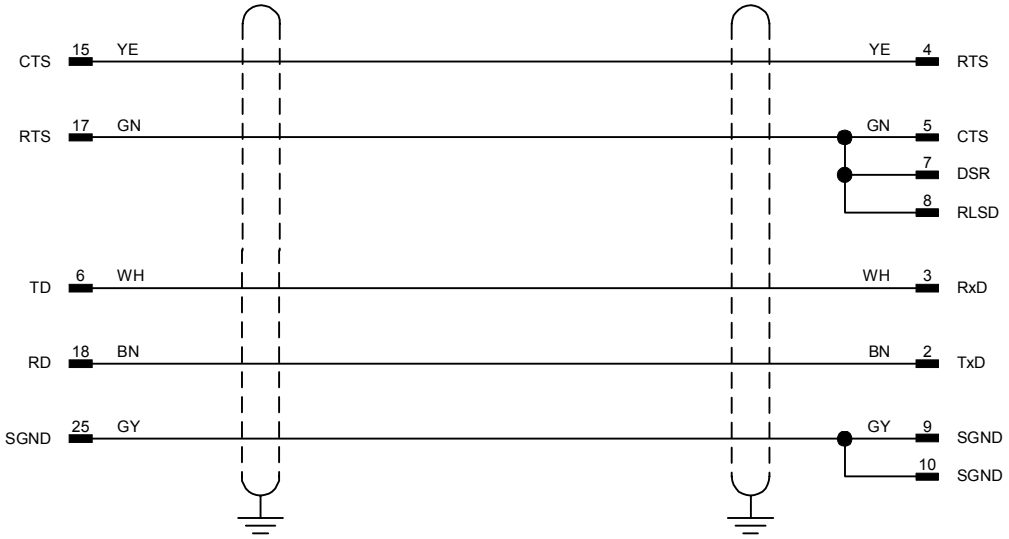
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.7.3.3 Cable X3 SER1 RS232 - ABB T200

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

ABB PLC T200




D-SUBmale connector 25 pin

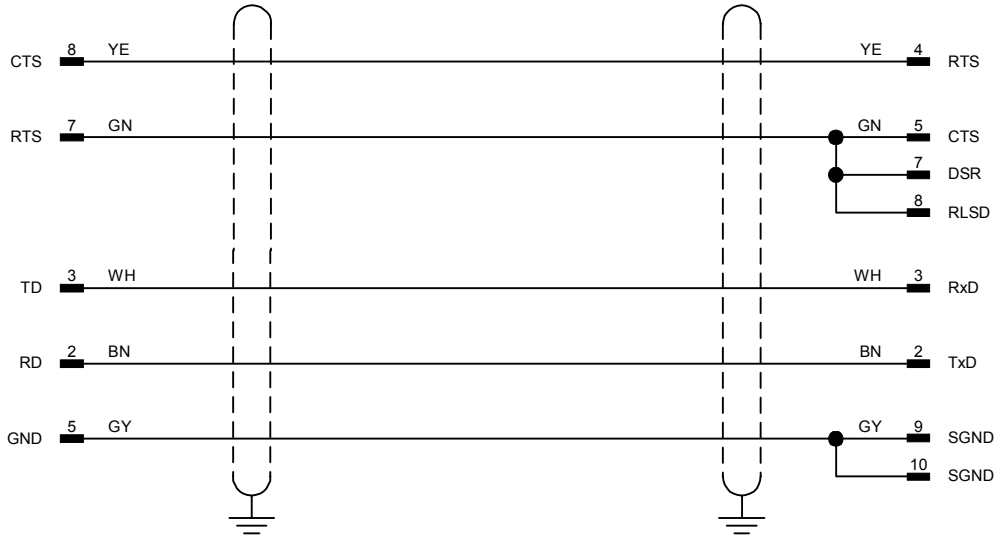
D-SUBmale connector 15 pin

#### 5.7.3.4 Cable X2 RS232 - ABB T200

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

ABB PLC T200




D-SUBmale connector 9 pin

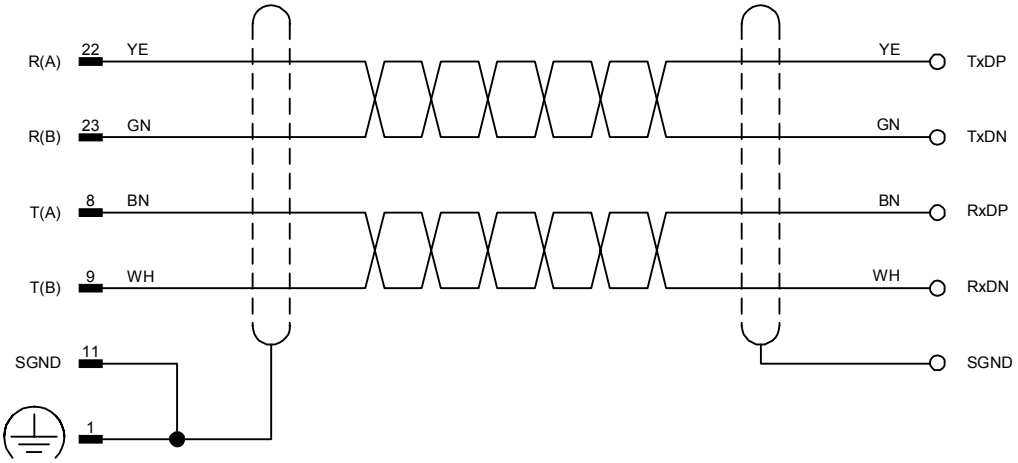
D-SUBmale connector 15 pin

#### 5.7.3.5 Cable X3 SER1 RS485 - ABB T200

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

ABB PLC T200




D-SUBmale connector 25 pin

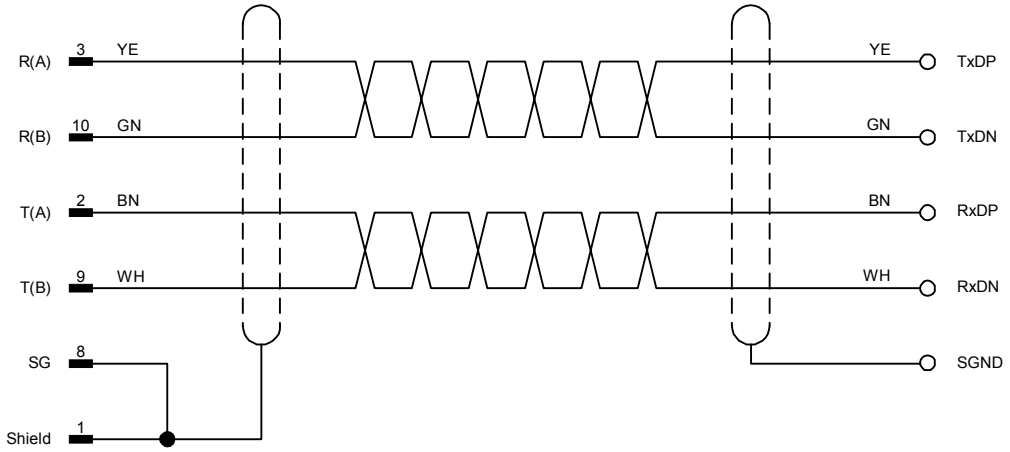
Wire end open with wire end ferrules

#### 5.7.3.6 Cable X2 RS485 - ABB T200

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

ABB PLC T200




D-SUBmale connector 9 pin

Wire end open with wire end ferrules

### 5.7.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-116 ABB T200 error messages

| Code | Subcode | Error Type | Possible cause |
|---|---|---|---|
| 1 | | Slave not ready | |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 4 | | Waiting time elapsed (Timeout) | Connection broken. |
| 5 | | CRC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| 50 | | Communication error on hardware level | |
| | 1 | Hardware error on acknowledgment to Occu Open | |
| | 2 | Hardware error on acknowledgment to Occu Close | |
| | 3 | Hardware error on acknowledgment to Response | |
| 51 | | Communication error on protocol level | |
| | 1 | Response acknowledged with NAK | |
| | 2 | Response acknowledged with NAK | |
| | 3 | Response acknowledged with NAK | |
| | 10 | Timeout error on acknowledgment to Occu Open | |
| | 11 | Timeout error on acknowledgment to Occu Close | |
| | 12 | Timeout error on acknowledgment to Response | |
| | 20 | Expected number of data bytes not correct | |
| | 21 | Echo does not match transmission | |

Table 5-116 ABB T200 error messages

| Code | Subcode | Error Type | Possible cause |
|---|---|---|---|
| 52 | | Error in telegram. The subcode contains the error number of the controller. | |
| | 1 | 0 +01 Number exceeds limit | |
| | 6 | 0 + 06 Wrong I/O code | |
| | 7 | 0+07 I/O number out of range | |
| | 10 | 10+0 CPU is available, however, no access authorization | |
| | 24 | 20+4 Terminal has write authorization | |
| | 26 | 20+6 Read authorization in use by another controller | |
| | 28 | 20+8 Write authorization in use by another controller | |

## 5.8 AEG KS

The AEG KS protocol provides you:

– random read and write access to all data of the controller

– Read and write bit, byte, word and double-word access to all data.

The size of the address area depends on the controller that is being used.

The protocol supports a connection to all controllers of the AEG Modicon series. The KS functions are used for this purpose. Connect the TesiMod operating device with the PG interface (RS232) of the controller. The following controllers support the KS functions.

– AEG MICRO

– AEG 120 and

– AEG 250.

### 5.8.1 Data Types

Direct access is possible to the following data types.

Table 5-117 Data types - AEG KS functions

| Type | Mnemonic | Access |
|---|---|---|
| Input | E | Bit Access |
| Input Byte | EB | Byte Access |
| Input Word | EW | Word Access |
| Input Double-Word | ED | Double-Word Access |
| Output | A | Bit Access |
| Output Byte | AB | Byte Access |
| Output Word | AW | Word Access |
| Output Double-Word | AD | Double-Word Access |
| Flag | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Flag Double-Word | MD | Double-Word Access |
| Flag floating point number (applies to A250 only) | MG | Double-Word Access |
| Timer Status | T | Byte Access |
| Timer Actual Value | TI | Word Access |
| Timer Setpoint Value | TS | Word Access |
| Counter | Z | Byte Access |
| Counter Actual Value | ZI | Word Access |
| Counter Setpoint Value | ZS | Word Access |

## 5.8.2 Programming

### 5.8.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.8.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-118 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.8.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-119 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.8.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-120 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.8.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-121 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.8.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-122 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.8.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

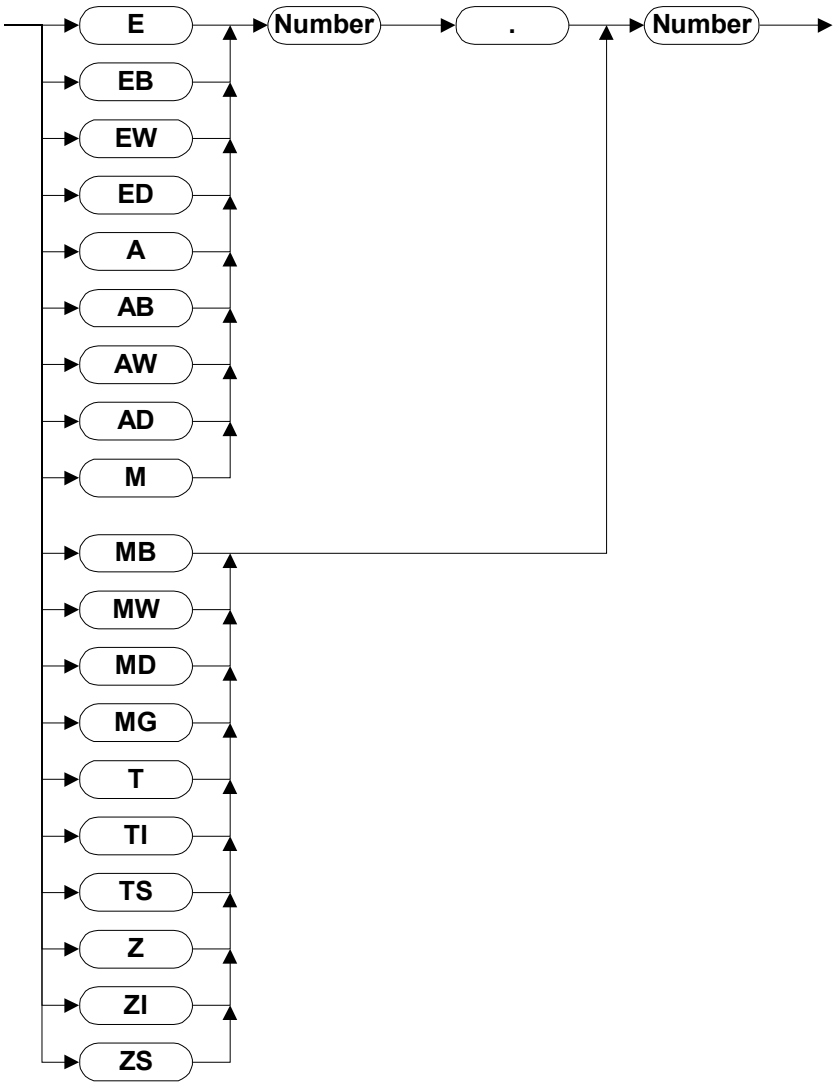



Figure 5-27 Syntax diagram

### 5.8.3 Physical Interfacing

Plug-in connections on the operating device for connecting to controllers with various communication modules.

#### 5.8.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-123 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

Table 5-124 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Table 5-125 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.8.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-126 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

Table 5-127 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

Table 5-128 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |

Table 5-128 Pin assignment X2 RS485

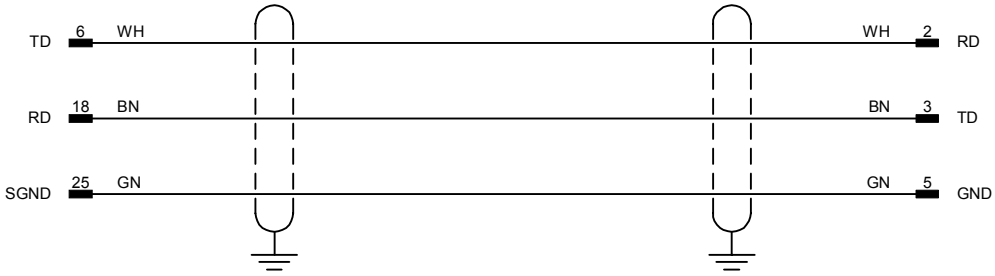
| Pin | Designation | Function |
|---|---|---|
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.8.3.3 Cable X3 SER1 RS232 - AEG A120 and A250

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device AEGA120, A250




D-SUBmale connector 25 pin

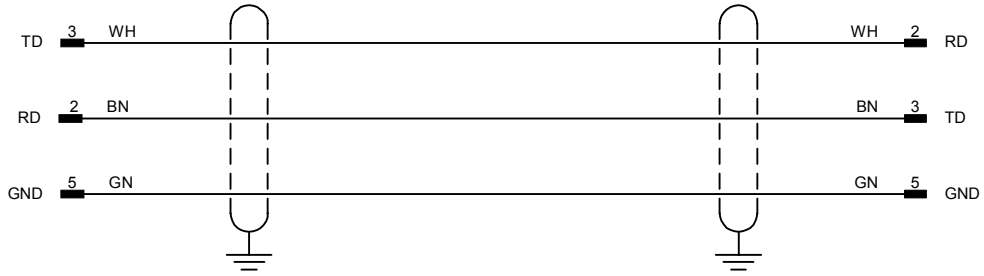
D-SUBmale connector 9 pin

Both ends of the shield are connected to the metallic housing.

#### 5.8.3.4 Cable X2 RS232 - AEG A120 and A250

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device AEGA120, A250




D-SUBmale connector 25 pin

D-SUBmale connector 9 pin

Both ends of the shield are connected to the metallic housing.

### 5.8.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-129 AEG KS error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 1 | Slave not ready | |
| | 2 | Packets out of sequence | |
| | 3 | Error in protocol frame | |
| | 4 | Waiting time elapsed (Timeout) | Connection broken. |
| | 5 | CRC error | |
| | 6 | Wrong parity | |
| | 7 | Send process aborted | |
| | 8 | Receive process aborted | |
| | 9 | Cyclic buffer overrun | Cyclic buffer too small |
| | 10 | No cyclic data defined | |
| | 12 | Cyclic data already defined | |
| | 15 | Protocol error | The selected protocol is not supported. |
| | 16 | Receive buffer overrun | |
| | 40 | System variable error | Undefined system variable |
| Error from data link layer | | | |
| 1 | 50 | No acknowledgment on polling | |
| | 51 | No acknowledgment on order telegram | |
| | 52 | No acknowledgment on tele-polling | |
| | 54 | Timeout - No reaction to polling | |
| | 55 | Timeout - No response telegram | |
| | 56 | Timeout - No reaction to response acknowledgment | |
| Error from the controller | | | |
| 3 | 05 | Wrong operand type | |
| | 06 | Out of range | |

## 5.9 Allen Bradley

The Allen Bradley DF1 protocol provides you

– random read and write access to all data of the controller
– bit and word access to all data of an **integer file** in read and write mode.

Before individual bits of a word can be accessed for a write operation, a read access to the entire word is performed. After the bit changes, the write access to the entire word is carried out. For this type of access, you must therefore ensure that the operating device and the controller do not simultaneously modify individual bits of the same word.

The size of the address area depends on the controller being used.

The protocol supports a connection to all controllers which are supported by the DF1 protocol such as the following controller types.

– MicroLogix 1000 family,
– SLC500 with SLC5/03,
– SLC500 with SLC4/04,
– PLC5 and
– PLC5/250.

### 5.9.1 Data Types

Direct access is possible to the following data types.

You can specify a data file number for each variable in the variable list.

**Configurable Values** 9 to 254

A corresponding integer data file must be created in the PLC5 controller for each data file number you entered.

Table 5-130 Allen Bradley data types

| Type | Mnemonic | Access |
|---|---|---|
| Bit | B | Bit Access to Word Address |
| Word | W | Word Access to Word Address |
| Double Word | DW | Double-Word Access to Word Address |

## 5.9.2 Programming

### 5.9.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.9.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-131 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.9.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-132 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.9.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-133 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.9.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-134 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.9.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-135 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.9.2.1.6 PLC Type

This parameter specifies which controller is used.

Table 5-136 PLC Type

| Configurable Values | Default Value |
|---|---|
| SLC500-5/03 | X |
| PLC5 | |

#### 5.9.2.1.7 Block Check

This parameter specifies the block check to be performed for the communication.

Table 5-137 Block check

| Configurable Values | Default Value |
|---|---|
| CRC16 | X |
| LRC8 | |

#### 5.9.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

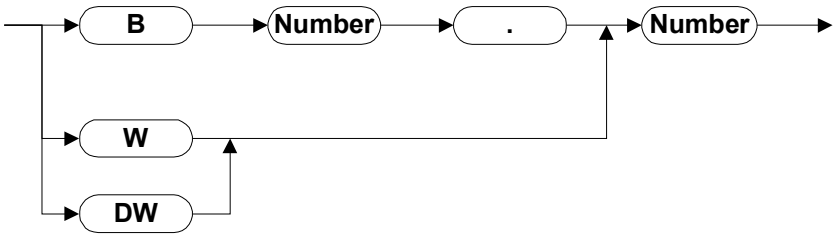



Figure 5-28 Syntax diagram

### 5.9.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.9.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-138 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Table 5-139 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.9.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-140 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

Table 5-141 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

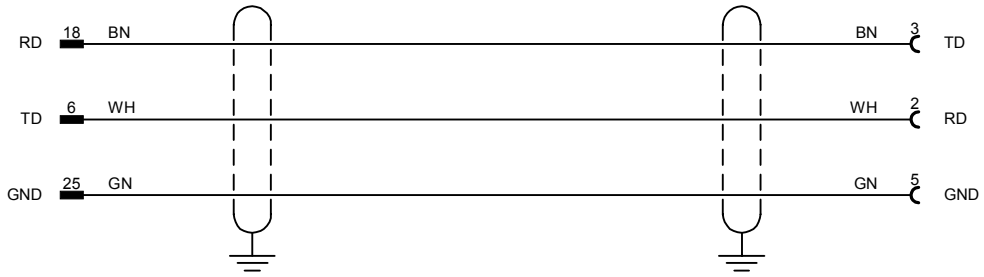
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.9.3.3 Cable X3 SER1 RS232 - Allen Bradley SLC 500-5/03

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Allen Bradley
SLC 500-5/03




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

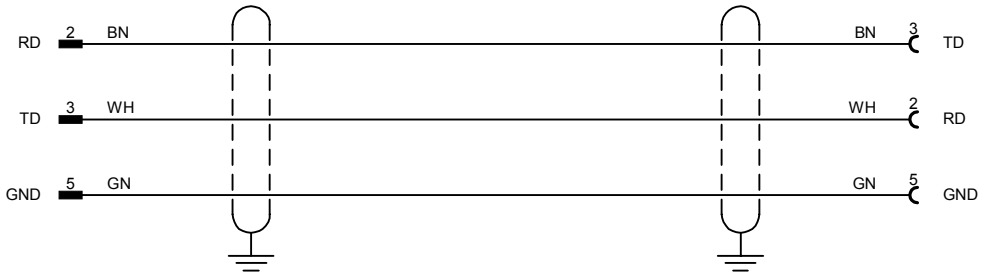
Both ends of the shield are connected to the metallic housing.

#### 5.9.3.4 Cable X2 RS232 - Allen Bradley SLC 500-5/03

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Allen Bradley
SLC 500-5/03




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

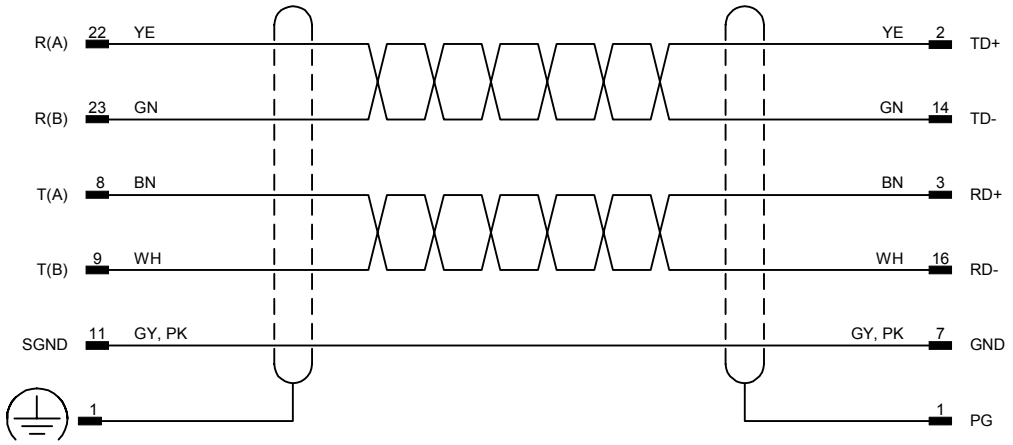
Both ends of the shield are connected to the metallic housing.

#### 5.9.3.5 Cable X3 SER1 RS485 - Allen Bradley PLC 5

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Allen Bradley
PLC 5 Channel 0




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

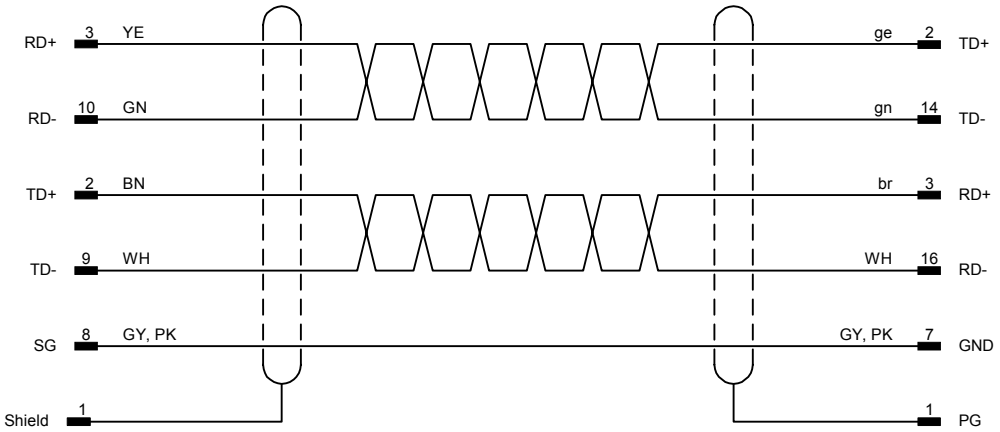
Both ends of the shield are connected to the metallic housing.

### 5.9.3.6 Cable X2 RS485 - Allen Bradley PLC 5

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Allen Bradley
PLC 5 Channel 0




D-SUB
male connector
15 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

### 5.9.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-142 Allen Bradley error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 1 | Slave not ready | |
| | 2 | Packets out of sequence | |
| | 3 | Error in protocol frame | |
| | 4 | Waiting time elapsed (Timeout) | Connection broken. |
| | 6 | Wrong parity | |
| | 7 | Send process aborted | |
| | 8 | Receive process aborted | |
| | 9 | Cyclic buffer overrun | Cyclic buffer too small |
| | 10 | No cyclic data defined | |
| | 12 | Cyclic data already defined | |
| | 15 | Protocol error | The selected protocol is not supported. |
| | 16 | Receive buffer overrun | |
| | 17 | NAK from controller despite repetitions | |
| | 40 | System variable error | Undefined system variable |
| | 50 | No acknowledgment for order telegram | |
| | 51 | Acknowledgment for order telegram is NAK | |
| | 52 | Wrong character for acknowledgment | |
| | 53 | Non-interpretable reply | |
| | 55 | Timeout - No response telegram | |
| | 56 | Timeout - No response telegram | |
| | 240 | Access to PLC is not possible (locked) | This error occurs when a PLC program is downloaded. Afterwards the operating device shows code 1, subcode 56. In the protocol parameters of channel 0 for the PLC, deselect the parameter "Duplicate Packet Detect". |

Table 5-142 Allen Bradley error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 2 | 58 | Incorrect number of data received | Check if the mask, in which the error occurred, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| Error from the controller | | | |
| 3 | 10 | Error in the command message | |
| | 50 | Access to invalid address in controller | |

## 5.10 Bosch BUEP19

The Bosch BUEP19 protocol allows you:

– random read and write access to all PLC data
– bit-by-bit access to all byte, word and double-word oriented data types
– byte-by-byte access to all data words in a data block.

When the system writes to individual bits and individual bytes of a flag word, a read-access is performed first. Then, the entire data structure can be accessed for a write operation. During this type of access, you must therefore take care that the operating device and the controller do not modify individual bits in a byte (or individual bytes in a data word).

The size of the address area depends on the controller being used.

This protocol supports a connection to the following CPU modules:

– ZE300
– ZE301
– R300
– R301
– R600

### 5.10.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the controller of the controller's CPU.

Table 5-143 Data types for Bosch BUEP19

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | BE | Bit Access |
| Input Byte | BYE | Byte Access |
| Input Word | WE | Word Access |
| Input Double-Word | DWE | Word Access |
| Output Bit | BA | Bit Access |
| Output Byte | BYA | Byte Access |
| Output Word | WA | Word Access |
| Output Double-Word | DWA | Word Access |
| Flag Bit | BM | Bit Access |
| Flag Byte | BYM | Byte Access |
| Flag Word | WM | Word Access |
| Flag Double-Word | DWM | Word Access |
| Timer Word | WT | Word Access, R300 and R600 read-only |
| Counter Word | WZ | Word Access, R300 and R600 read-only |

Table 5-143 Data types for Bosch BUEP19

| Type | Mnemonic | Access |
|---|---|---|
| Data Buffer Word | WDP | Word Access0 to 510 for ZE300<br>Access is possible to even-numbered addresses only. |
| Data Word | DBxWD | Word Access0 to 510<br>Access is possible to even-numbered addresses only |
| Data Double-Word | DBxDWD | Word Access<br>Access is possible to even-numbered addresses only |

**Counter:** When a counter address is accessed, the counter value is interpreted in binary form. The maximum counter value is 8191.

**Timer:** Timer values are made up of a time value and a time base.

The operating device reads the 2-byte variable and converts it internally into an imaginary, unsigned 4-byte variable, that represents the time value in reference for the base 0.01 seconds.

Before the operating device writes a timer value to the controller, it converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base.

## 5.10.2 Programming

### 5.10.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.10.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-144 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.10.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-145 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.10.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-146 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.10.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-147 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.10.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-148 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.10.2.1.6 Use Coordination Flag

This parameter specifies whether you are using a coordination flag for the communication.

Table 5-149 Use coordination flag

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

#### 5.10.2.1.7 Coordination Flag

This parameter contains the number of the coordination flag you want to use for the communication.

Table 5-150 Coordination flag

| Configurable Values | Default Value |
|---|---|
| 0 to 255 | 0 |

#### 5.10.2.1.8 Bit Number

This parameter specifies the number of the bit in the coordination flag.

Table 5-151 Bit number

| Configurable Values | Default Value |
|---|---|
| 0 to 7 | 0 |

#### 5.10.2.1.9 Destination Module

This parameter specifies the CPU module you are using.

Table 5-152 Destination module

| Configurable Values | Default Value |
|---|---|
| ZE300/ZE301 | X |
| R300/R300B | |
| R600/R600B | |

#### 5.10.2.1.10 Block Check

This parameter specifies the block check to be performed for the communication.

Table 5-153 Block Check

| Configurable Values | Default Value |
|---|---|
| CRC16 | |
| LRC8 | X |

#### 5.10.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

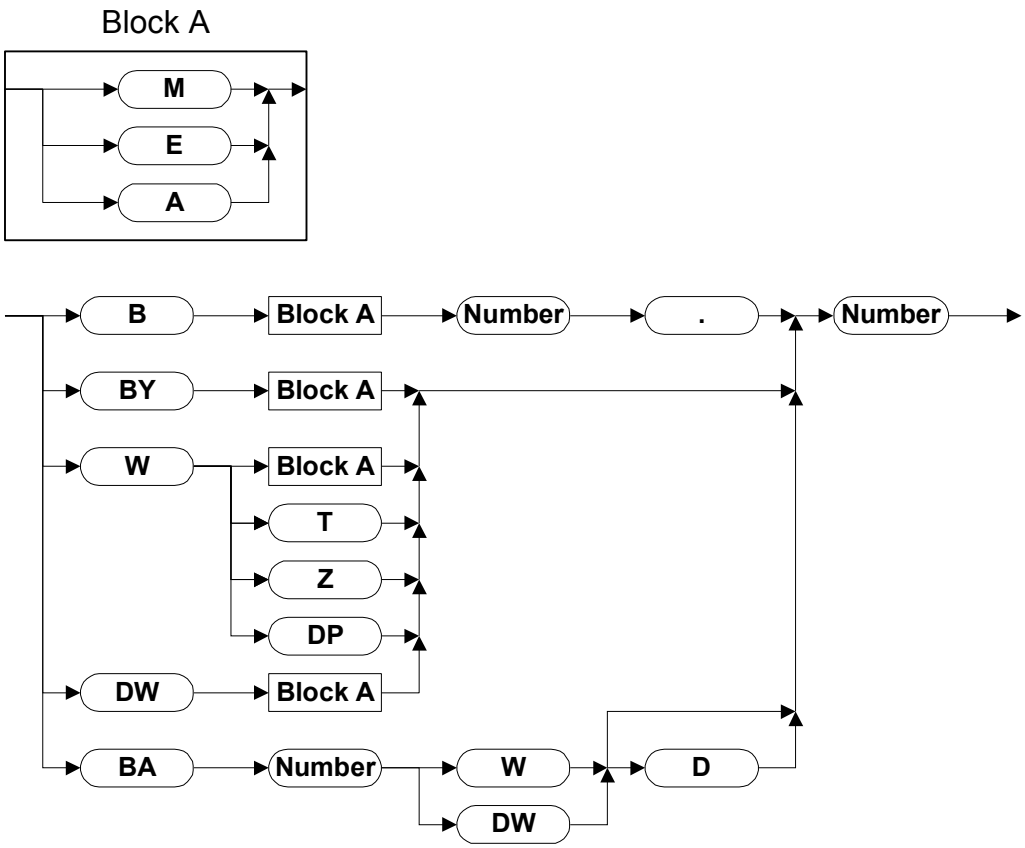



Figure 5-29 Syntax diagram

## 5.10.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.10.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-154 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

The D-SUB connectors must be sufficiently shielded. See chapter “Schirmung von D-SUB-Steckverbindungen“ on page 6-1.

### 5.10.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-155 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

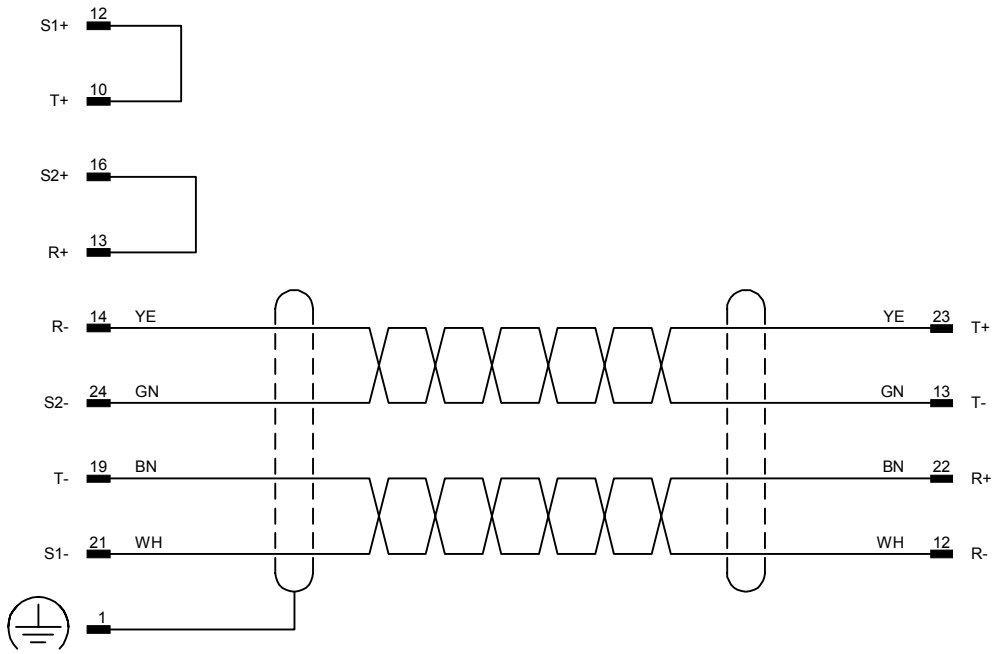
The D-SUB connectors must be sufficiently shielded. See chapter “Schirmung von D-SUB-Steckverbindungen“ on page 6-1.

#### 5.10.3.3 Cable X3 SER1 TTY / 20 mA - Bosch PU

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device
Transmitter active
Receiver active

Bosch
e.g. Z301
Transmitter passive
Receiver passive




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

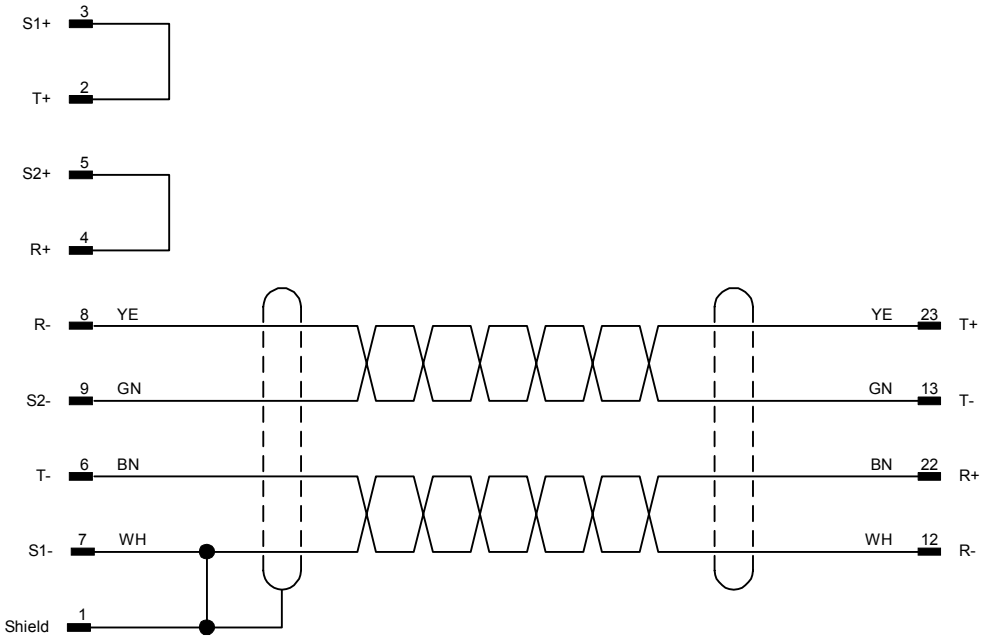
Both ends of the shield are connected to the metallic housing.

#### 5.10.3.4 Cable X2 TTY / 20 mA - Bosch PU

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device
Transmitter active
Receiver active

Bosch
e.g. Z301
Transmitter passive
Receiver passive




D-SUB
male connector
9 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

### 5.10.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-156 Error Messages for Bosch BUEP19

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong baud rate or cable defective |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 4 | | Waiting time elapsed (Timeout) | Connection interrupted. |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| Bosch-Specific Error Messages | | | |
| 50 | | No connection set-up | |
| 51 | | Wrong acknowledgement during connection set-up | |
| 52 | | Wrong acknowledgement after sending information block | |
| 53 | | No response telegram | |
| 54 | | Timeout - No response telegram | |
| 55 | | Block time exceeded | |
| 56 | | No acknowledgement | |
| 57 | | EOT - Aborted by controller | |

Table 5-156 Error Messages for Bosch BUEP19

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 58 | | Incorrect number of data received | Check if the mask, in which the error occured, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| Error from Programmable Controller | | | |
| 62 | | 32 from programmable controller | Write access to T or Z to module not allowed. |
| 67 | | 37 from programmable controller | Wrong parameter |
| 68 | | 38 from programmable controller | Number of bytes received is incorrect according to message header |
| 69 | | 39 from programmable controller | Wrong P1 for system message |
| 71 | | 41 from programmable controller | Direction not defined |
| 72 | | 42 from programmable controller | DB too small |
| 74 | | 44 from programmable controller | DB not programmed |
| 76 | | 46 from programmable controller | DB not defined |
| 78 | | 48 from programmable controller | Block type unknown |
| 79 | | 49 from programmable controller | Parameter 2 is 0 |
| 94 | | 64 from programmable controller | Wrong telegram type |

## 5.11 Bosch BUEP19E

The Bosch BUEP19E protocol allows you:

– random read and write access to all PLC data
– bit-by-bit access to all byte, word and double-word oriented data types
– byte-by-byte access to all data words in a data block.

The size of the address area depends on the controller being used.

This protocol supports a connection to the following CPU modules:

– CL200
– CL350
– CL400
– CL500

### 5.11.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the controller of the controller's CPU.

Table 5-157 Data types for Bosch BUEP19E

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | BE | Bit Access |
| Input Byte | BYE | Byte Access |
| Input Word | WE | Word Access |
| Input Double-Word | DWE | Word Access |
| Output Bit | BA | Bit Access |
| Output Byte | BYA | Byte Access |
| Output Word | WA | Word Access |
| Output Double-Word | DWA | Word Access |
| Flag Bit | BM | Bit Access |
| Flag Byte | BYM | Byte Access |
| Flag Word | WM | Word Access |
| Flag Double-Word | DWM | Word Access |
| Timer Word | WT | Word Access<br>0 to 127 |
| Counter Word | WZ | Word Access<br>0 to 127 |
| Data Buffer Byte | BYDP | Byte Access<br>0 to 511 |
| Data Buffer Word | WDP | Word Access<br>0 to 511 |
| Data Block Byte | DBxBYD | Byte Access<br>0 to 511 |

Table 5-157 Data types for Bosch BUEP19E

| Type | Mnemonic | Access |
|---|---|---|
| Data Block Word | DBxWD | Word Access<br>0 to 511 |
| Data Block Double-Word | DBxDWD | Word Access |
| Data Field Byte | BLxBYDF | Byte Access<br>0 to 24575 |
| Data Field Word | BLxWDF | Word Access<br>0 to 24575 |
| Data Field Double-Word | BLxDWDF | Word Access<br>0 to 24575 |

**Counter:** When a counter address is accessed, the counter value is interpreted in binary form. The maximum counter value is 8191.

**Timer:** Timer values are made up of a time value and a time base.

The operating device reads the 2-byte variable and converts it internally into an imaginary, unsigned 4-byte variable, that represents the time value in reference for the base 0.01 seconds.

Before the operating device writes a timer value to the controller, it converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base.

**Data field:** If you defined the data field as a linear area, the data field number must be set to the value 255.

## 5.11.2 Programming

### 5.11.2.1 Protocol Parameters

You can use the protocol parameters to influence the communication between the operating device and the controller. All parameters are set to the default values which ensure a reliable communication.

#### 5.11.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-158 Baud rate, Bosch PU BUEP19E

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.11.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-159 Parity, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.11.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-160 Handshake, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.11.2.1.4 Data Bits

This parameter specifies the number of the data bits.

Table 5-161 Data bits, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.11.2.1.5 Stop Bits

This parameter specifies the number of the stop bits.

Table 5-162 Stop bits, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.11.2.1.6 Use Coordination Flag

This parameter specifies whether you want to use a coordination flag for communication.

Table 5-163 Use coordination flag, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

#### 5.11.2.1.7 Coordination Flag

This parameter contains the number of the coordination flag you want to use for communication.

Table 5-164 Coordination flag, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| 0 to 255 | 0 |

#### 5.11.2.1.8 Process Coordination Flag

This parameter specifies the number of the process coordination flag.

Table 5-165 Process coordination flag, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| 0 (System stop state) | X |
| 1 (System RUN state) | |
| 2 (I/O status) | |
| 3 (I/O status or STOP | |
| 4 (PE) | |
| 5 (PE or STOP) | |
| 6 (OB1) | |
| 7 (OB1 or STOP) | |
| 15 (no process coordination) | |

#### 5.11.2.1.9 Destination Module

This parameter specifies the CPU module you are using.

Table 5-166 Destination module, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| CL500 | X |
| CL350/CL400 | |
| CL200 | |

#### 5.11.2.1.10 Block Check

This parameter specifies the block check to be performed for the communication.

Table 5-167 Block check, Bosch PU BUEP19E

| Configurable Values | Default Value |
|---|---|
| CRC16 | |
| LRC8 | X |

#### 5.11.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

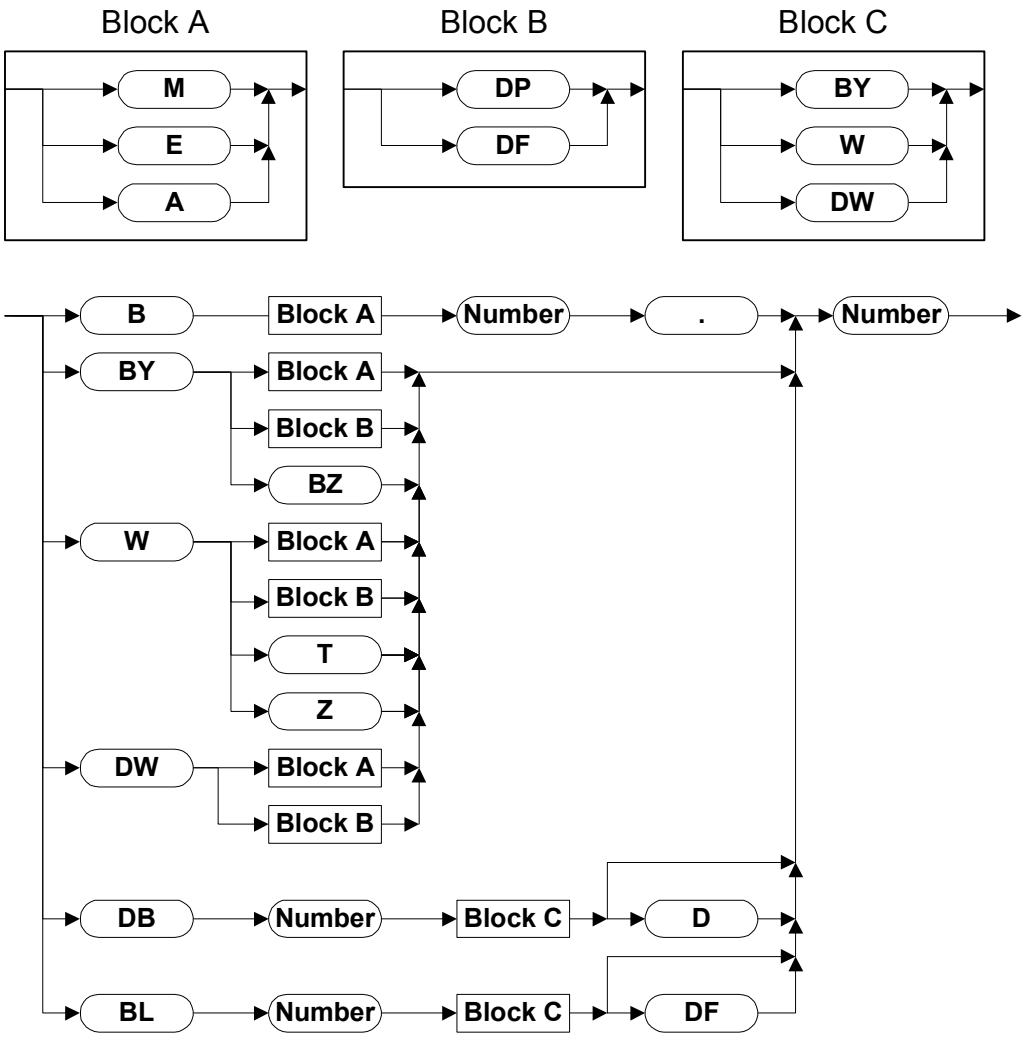



Figure 5-30 Syntax diagram for Bosch BUEP19E

## 5.11.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the PU interface of the Bosch controller.

### 5.11.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-168 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

The D-SUB connectors must be sufficiently shielded. See chapter “Schirmung von D-SUB-Steckverbindungen“ on page 6-1.

### 5.11.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-169 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

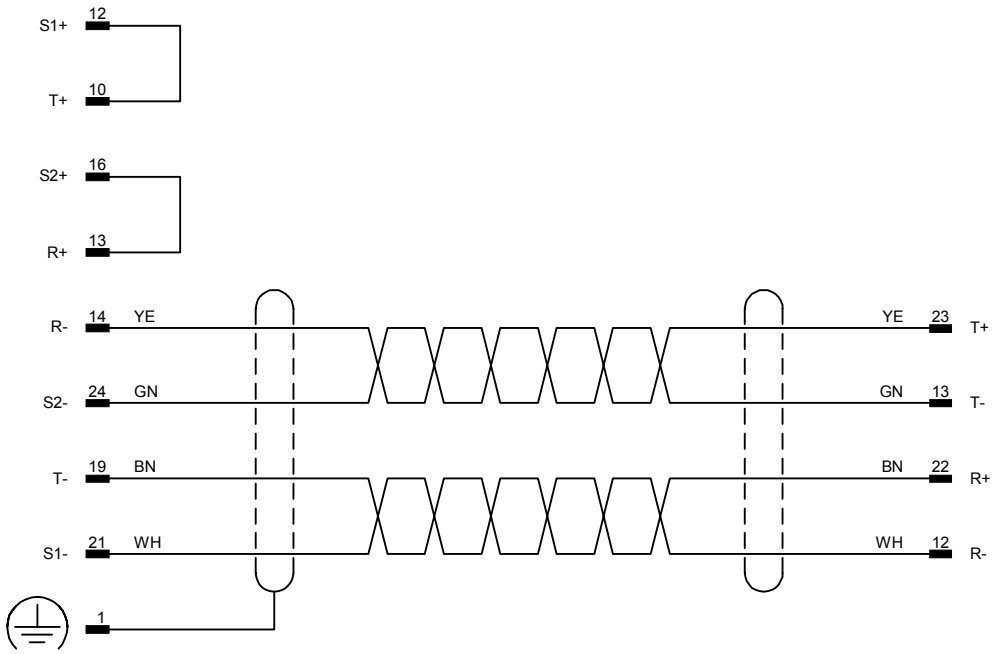
The D-SUB connectors must be sufficiently shielded. See chapter “Schirmung von D-SUB-Steckverbindungen“ on page 6-1.

#### 5.11.3.3 Cable X3 SER1 TTY / 20 mA - Bosch PU

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device
Transmitter active
Receiver active

Bosch
e.g. SK500
Transmitter passive
Receiver passive




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

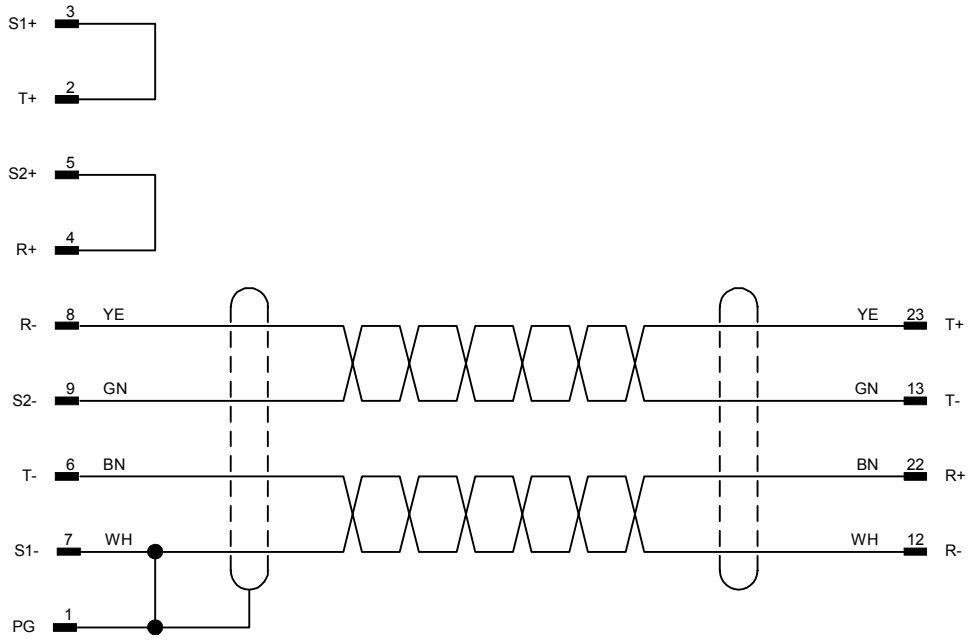
Both ends of the shield are connected to the metallic housing.

#### 5.11.3.4 Cable X2 TTY / 20 mA - Bosch PU

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device
Transmittier active
Receiver active

Bosch
e.g. SK500
Transmitter passive
Receiver passive




D-SUB
male connector
9 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

### 5.11.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-170 Error Messages for Bosch BUEP19E

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 1 | Slave not ready | Wrong baud rate or cable defective |
| | 3 | Error in protocol frame | |
| | 5 | CRC error | |
| | 6 | Wrong parity | |
| | 10 | No cyclic data defined | |
| | 16 | Receive buffer overrun | |
| Bosch-Specific Error Messages | | | |
| 1 | 50 | No connection set-up | |
| | 51 | Wrong acknowledgement during connection set-up | |
| | 52 | Wrong acknowledgement after sending information block | Wrong block check set, PG uses LRC8. The first peripheral participant determines the block check used ! |
| | 53 | No response telegram | |
| | 54 | Timeout - No response telegram | |
| | 55 | Block time exceeded | |
| | 56 | No acknowledgement | |
| | 57 | EOT - Aborted by controller | |
| 2 | 58 | Incorrect number of data received | Check if the mask, in which the error occured, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |

Table 5-170 Error Messages for Bosch BUEP19E

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| Error from Programmable Controller | | | |
| 3 | 1 | Addressed module does not exist | |
| | 16 | Module cannot be addressed | |
| | 35 | The address field has been protected by the user | |
| | 36 | Access to this address field is not permitted | |
| | 37 | Writing to timer is not allowed | |
| | 38 | Block number too large | |
| | 39 | Block does not exist | |
| | 40 | Block too small | |
| | 147 | Flag area (CL200 only) exceeded | Flag area defined is outside of BYM0 to BYM191 |
| 4 | 32 | Addressed data type (command code) unknown in PST (peripheral station) | |
| | 33 | Protocol code unknown in PST | |
| | 35 | Specified coordination flag unknown in PST | |
| | 37 | Parameter code in telegram and specified parameters do not match | |
| | 38 | Block length and actual number of data do not match | |
| | 40 | Telegram type unknown | |
| | 41 | Command type unknown | |
| | 58 | Starting address and operand type do not match (word at odd address) | Defective R500 module possible |
| | 59 | Starting address outside of specified address range | |
| | 60 | Invalid parameter for specified command | |
| | 61 | Invalid operand type | |
| | 64 | PST has not received an identification telegram | |
| | 99 | Specified data length greater than addressed data area | |
| | 210 | Coordination flag is disabled | |
| Error from Operating Device | | | |
| 40 | | System variable error | Undefined system variable |

## 5.12 CAN

TesiMod operating devices with the CAN interface closely conform with the "CANopen Communication Profile" specification. The interface complies with the specifications of ISO-DIS 11898.

CANopen uses a subset of the CAL (CAN Applications Layer) communication services. TesiMod operating devices allow access to the data of devices on the CANopen bus by means of special PDOs or SDOs.

By defining up to 15 communication relations, the TesiMod operating device can access the data of up to 15 different devices.

### 5.12.1 Data Objects

All CANopen data are located in an object dictionary with an index and a subindex. Data packets which can be exchanged on a CANopen network are referred to as communication objects. The communication objects are divided up into **PDO**s (process data objects) and **SDO**s (service data objects).

PDOs (process data objects):

– Maximum length = 8 bytes.
– Contain 1 to 64 data objects from the object dictionary. Their contents is defined by the device manufacturer.

SDOs (service data objects):

– Direct access to the object dictionary via index and subindex.
– Data of any size can be transmitted.

### 5.12.2 Identifier

Every communication object is identified by a unique identifier. Every PDO is a communication object to which an identifier is assigned. Two communication objects are always required for communications based on using SDOs. An identifier is assigned to each of the two communication objects.

### 5.12.3 PDO Communication

#### 5.12.3.1 Indirect process data communication

An operating device is generally capable of displaying or changing a data volume many times larger than that which can be exchanged using a PDO.

In addition, the PDOs predefined by the device manufacturer usually do not contain the data to be processed by the TesiMod operating device. For this reason, the TesiMod operating device does not access data objects directly but through special communication objects,

– a request PDO and
– a response PDO.

The request PDO and response PDO are used to establish a point-to-point connection on the data level between two devices.

#### 5.12.3.2 Data exchange sequence

**Operating device is the client**

All services required for the operation of the operating device are initiated by the operating device itself, i. e. the operating device has client functionality.

**Communication partner is the server**

The communication partner merely responds to requests from the operating device, i. e. the communication partner has server functionality.

The operating device sends a request PDO and the communication partner returns a response PDO as a reply/acknowledgment.

If the communication partner receives a request object from the operating device, it interprets the first 4 bytes for data direction and accessed data object.

In the case of a write request, it stores the received data and returns a blank response PDO for acknowledgment.

In the case of a read request, it transfers the requested data to the operating device via a response PDO.

Request PDO and response PDO always exist in pairs. Each pair stands for one communication relation between the operating device and **one** station.

#### 5.12.3.3 Structure of Request and Response PDO

Request and response PDO are each 8 bytes in size. The first four bytes of these objects contain the definition of the accessed data object from the object dictionary. The remaining 4 bytes contain the data.

Table 5-171 Structure of request and response PDO

| Byte | Content |
|---|---|
| 1 | Status |
| 2 | Index Low |
| 3 | Index High |
| 4 | Subindex |
| 5 | User Data |
| 6 | |
| 7 | |
| 8 | |

#### 5.12.3.4 Structure of the Status Byte

The status byte within the request and response PDO has the following structure.

Table 5-172 Structure of the status byte in a request and response PDO

| Bit | Designation | Value | Access | Description |
|---|---|---|---|---|
| 0 | Length | 1, 2 , 3, 4 | Bit Byte Word Double-Word | Length of the Set/Delete bit mask Number in bytes Number in bytes Number in bytes |
| 1 | | 2,4 | | |
| 2 | | 4 | | |
| 3 | Toggle bit | | | This bit toggles with each PDO. This indicates to the controller that a new PDO has been received. |

Table 5-172 Structure of the status byte in a request and response PDO

| Bit | Designation | Value | Access | Description |
|---|---|---|---|---|
| 4 | Telegram type | 0<br>1 | | Request telegram<br>Response telegram |
| 5<br>6 | Access | 0<br>1<br>2<br>3 | Bit<br>Byte<br>Word<br>Double-Word | Bit access in write mode (set/delete)<br>Read or write byte<br>Read or write word<br>Read or write double-word |
| 7 | Control bit | 0<br>1<br>0<br>1 | | Request PDO = write<br>Request PDO = read<br>Response PDO = No error<br>Response PDO = Error from the controller during telegram processing. The first data byte contains the error number. |

#### 5.12.3.5 Index bytes

This value specifies the index from the communication partner's object dictionary. The index points to:

– one variable without subindex,
– the beginning of an array,
– the beginning of a record.

If you do not use CANopen, the numbering between communication partners can be declared here as desired.

#### 5.12.3.6 Subindex Byte

This value specifies the subindex from the communication partner's object dictionary. The subindex points to one variable (basic CAN variable) of the size of the access.

If you do not use CANopen, the numbering between communication partners can be declared here as desired.

#### 5.12.3.7 User data bytes of request and response PDO

The user data are classified by the type of access.

Table 5-173 User data, bit-oriented in a byte address

| Byte | Content |
|---|---|
| 5 | AND mask |
| 6 | |
| 7 | OR mask |
| 8 | |

Table 5-174 User data, bit-oriented in a word address

| Byte | Content |
|---|---|
| 5 | AND mask low byte |

Table 5-174 User data, bit-oriented in a word address

| Byte | Content |
|---|---|
| 6 | AND mask high byte |
| 7 | OR mask low byte |
| 8 | OR mask high byte |

The bit masks must be linked in the controller with the specified address using the OR or AND logical operations, where the AND mask deletes bits and the OR mask sets bits.

Table 5-175 User data, byte-oriented in a word address

| Byte | Word | Content |
|---|---|---|
| 5 | 1 | Byte 1 |
| 6 | | Byte 2 |
| 7 | 2 | Byte 3 |
| 8 | | Byte 4 |

Table 5-176 User data, double-word oriented in a word address

| Byte | Double word | Content |
|---|---|---|
| 5 | 1 | Lowest byte |
| 6 | | Byte |
| 7 | | Byte |
| 8 | | Highest byte |

#### 5.12.3.8 Response Object With an Error

If a communication error occurs, a response object with the following structure is returned.

Table 5-177 Structure of the response object containing an error

| Byte | Content |
|---|---|
| 5 | Error number |
| 6 | |
| 7 | |
| 8 | |

#### 5.12.3.9 Tasks of the Communication Partner

The TesiMod operating device's communication partner has a server functionality. As a server, the communication partner is responsible for interpreting incoming telegrams and for replying with a response object. This procedure must be performed within the waiting time specified in the protocol parameters.

A response object must be transferred in reply to every request object. In the case of an error, the communication partner simultaneously transmits an error number to the operating device.

#### 5.12.3.9.1 Procedure for Communication Without Errors

1. The status byte of the request object is copied to the response object with the following change:

| | | | |
|---|---|---|---|
| Bit 7 | Control bit | 0 | Error-free action |
| Bit 4 | Telegram type | 1 | Response object |

2. Index and subindex are copied from the request object to the response object.
3. When the operating device writes data, the user data must be copied to the accessed address.
4. When the operating device reads data, the data must be copied from the accessed address to the address for the user data bytes.

#### 5.12.3.9.2 Procedure for Communication with Errors

If the communication partner detects an error in the request object contents, this can be indicated to the operating device through an error message in the response object.

The error numbers can be freely defined. The operating device always displays the communication error "Communication Error 100". The subcode of the error message contains the error number.

1. The status byte of the request object is copied to the response object with the following change:

| | | | |
|---|---|---|---|
| Bit 7 | Control bit | 1 | Error detected |
| Bit 4 | Telegram type | 1 | Response object |

2. Index and subindex are copied from the request object to the response object.
3. The error number is entered into byte 5.

## 5.12.4 SDO Communication

SDO communications are point-to-point connections. One station is always the client while the other acts as a server.

With CANopen, a distinction is made between a client SDO and a server SDO.

#### 5.12.4.1 Server SDO

Each CANopen module has a server SDO channel. This channel allows external access to the object dictionary.

#### 5.12.4.2 Client SDO

In addition to a server SDO channel, the TesiMod operating device also has a client SDO channel. This makes it possible to access the object dictionary using the server SDO channel of another device.

## 5.12.5 CANopen in TesiMod Operating Devices

#### 5.12.5.1 NMT Capability

The TesiMod operating device is a "minimum capability device" in accordance with DS301 and thus provides minimum NMT functionality (PRE_OPERATIONAL and OPERATIONAL only).

#### 5.12.5.2 Object Dictionary

Table 5-178 Object dictionary for CANopen

| Index | Object | Name | Type | Attribute |
|---|---|---|---|---|
| 0x1000 | VAR | device type | unsigned 32 | const |
| 0x1001 | VAR | error register | unsigned 8 | ro |
| 0x1004 | ARRAY | number of PDO supported | unsigned 32 | ro |
| 0x1008 | VAR | manufacturer device name | vis_string | const |
| 0x1009 | VAR | manufacturer hardware version | vis_string | const |
| 0x100A | VAR | manufacturer software version | vis_string | const |
| 0x100B | VAR | node ID | unsigned 32 | ro |
| 0x100C | VAR | guard time | unsigned 16 | rw |
| 0x100D | VAR | life time factor | unsigned 32 | rw |
| 0x100E | VAR | guard ID | unsigned 32 | ro |
| 0x100F | VAR | number of SDO supported | unsigned 32 | ro |
| 0x1010 | VAR | store parameters | unsigned 32 | rw |
| 0x1011 | VAR | restore default parameters | unsigned 32 | rw |
| 0x1014 | VAR | emergency ID | unsigned 32 | ro |
| 0x1200 | RECORD | 1st server SDO | SDO parameter | ro |
| 0x1280 | RECORD | 1st client SDO | SDO parameter | ro |
| 0x1281 | RECORD | 2nd client SDO | SDO parameter | ro |
| 0x1282 | RECORD | 3rd client SDO | SDO parameter | ro |
| 0x1283 | RECORD | 4th client SDO | SDO parameter | ro |
| 0x1284 | RECORD | 5th client SDO | SDO parameter | ro |
| 0x1285 | RECORD | 6th client SDO | SDO parameter | ro |
| 0x1286 | RECORD | 7th client SDO | SDO parameter | ro |
| 0x1287 | RECORD | 8th client SDO | SDO parameter | ro |

#### 5.12.5.3 Object Description

Described below are only objects which differ from the standard definition.

##### 5.12.5.3.1 Guard Time

Table 5-179 Guard time for CANopen

| Designation | Value |
|---|---|
| Index | 100Ch |
| Name | guard time |
| Object Code | VAR |
| Data Type | unsigned 16 |
| Object Class | optional |
| Access | rw |
| Value Range | 100 to 65535 |
| Default Value | 0 |

##### 5.12.5.3.2 Life Time Factor

Table 5-180 Life time factor for CANopen

| Designation | Value |
|---|---|
| Index | 100Dh |
| Name | life time factor |
| Object Code | VAR |
| Data Type | unsigned 8 |
| Object Class | optional |
| Access | rw |
| Value Range | 0 to 255 |
| Default Value | 0 |

#### 5.12.5.3.3 Store Parameters

Table 5-181 Store parameters for CANopen

| Designation | Value |
|---|---|
| Index | 1010h |
| Name | store parameters |
| Object Code | ARRAY |
| Number of Elements | 1 |
| Data Type | unsigned 16 |
| Sub Index | 4 |
| Description | save manufacturer parameters |
| Object Class | optional |
| Access | rw |
| Value Range | 65766173h |
| Default Value | no |

#### 5.12.5.3.4 Restore Default Parameters

Table 5-182 Store parameters for CANopen

| Designation | Value |
|---|---|
| Index | 1011h |
| Name | restore default parameters |
| Object Code | ARRAY |
| Number of Elements | 1 |
| Data Type | unsigned 32 |
| Sub Index | 4 |
| Description | restore manufacturer default |
| Object Class | optional |
| Access | rw |
| Value Range | 64616F6Ch |
| Default Value | no |

## 5.12.6 Programming

### 5.12.6.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.12.6.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-183 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 10 kBit/s | X |
| 20 kBit/s | |
| 50 kBit/s | |
| 100 kBit/s | |
| 125 kBit/s | |
| 250 kBit/s | |
| 500 kBit/s | |
| 1 MBit/s | |

#### 5.12.6.1.2 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-184 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 1 ms to 65535 ms | 1000 ms |

#### 5.12.6.1.3 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-185 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1 s to 255 s | 5 s |

#### 5.12.6.1.4 Register Errors in Serial Message System

If you activate this parameter, only Node Guarding and NMT service related errors are recorded.

Table 5-186 Register errors in serial message system

| Configurable Values | Default Value |
|---|---|
| ON | X |
| OFF | |

Enter the following error numbers and error descriptions into the list of error messages.

Table 5-187 Error messages for the serial message system for CAN

| Value | Text |
|---|---|
| General | |
| 9020 | Terminal is in PRE_OPERATIONAL state |
| 9021 | Terminal is in OPERATIONAL state |
| Only if terminal status = master | |
| 9012 | Timeout waiting for response when reading the guarding identifier |
| 9013 | Timeout waiting for response when reading the guard time |
| 9014 | Timeout waiting for response when reading the life time factor |
| 9015 | Timeout during guarding telegram |
| 9129 to 9255 | Emergency telegram from SDO partnersError number = 9000 + 128 + node number of the emergency message |

#### 5.12.6.1.5 Use CANopen

If you activate this parameter, you indicate that you are using CANopen.

Table 5-188 Use CANopen

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

Activating this parameter allows you to choose the following parameters:

– Terminal Status on the Bus
– CANopen NMT service

#### 5.12.6.1.6 Terminal Status on the Bus

Use this parameter to determine whether you want the TesiMod operating device to function as the master or the slave. This applies to SDO accesses, NMT services and node guarding.

Table 5-189 Terminal status on the bus

| Configurable Values | Default Value |
|---|---|
| Slave | X |
| Master | |

If you choose the value „Slave“, the TesiMod operating device - after initializing - expects a start/stop telegram from the master. In addition, it responds to NMT commands.

Table 5-190 NMT commands

| NMT Command | Byte 0 | Byte 1 | Operating Device Reaction |
|---|---|---|---|
| Start node | 1 | 0 | OPERATIONAL |
| Stop node | 2 | 0 | PRE_OPERATIONAL |
| Enter pre-operational | 128 | 0 | PRE_OPERATIONAL |
| Reset node | 129 | 0 | Communication Error 60, Reboot, PRE-OPERATIONAL |
| Reset communication | 130 | 0 | Reinitialize CAN, PRE-OPERATIONAL |

If you choose the value "Master", the parameter "Node guarding for SDO channels" is enabled and can then be selected. After the initializing phase, the operating device sends a global Start Node telegram to every station.

#### 5.12.6.1.7 Node Guarding for SDO Channels

A limited node guarding is performed.

A slave, which is accessed by the operating device per SDO, expects a Start Node telegram. During operation, the operating device monitors all SDO channels to verify that the stations are in the "OPERATIONAL" state. It uses a Node Guarding telegram for this purpose. If a station is not in this state, a Start Node telegram is sent to this station to restore it to the "OPERATIONAL" state.

Table 5-191 Node guarding for SDO channels

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

#### 5.12.6.1.8 Communication Relations

You can define up to 15 independent communication relations in table 15.

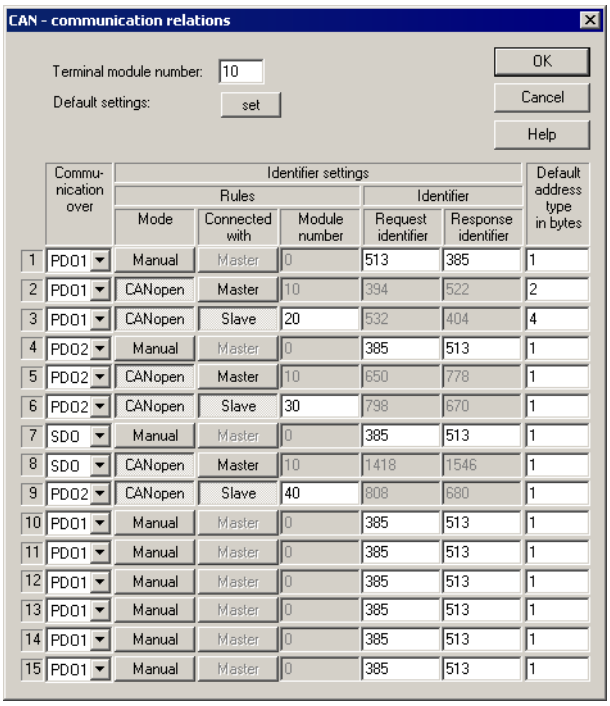

CAN - communication relations
Terminal module number: 10
Default settings: set
OK
Cancel
Help
Commu-nication over
Identifier settings
Rules
Identifier
Mode
Connected with
Module number
Request identifier
Response identifier
Default address type in bytes
1 PDO1 Manual Master 0 513 385 1
2 PDO1 CANopen Master 10 394 522 2
3 PDO1 CANopen Slave 20 532 404 4
4 PDO2 Manual Master 0 385 513 1
5 PDO2 CANopen Master 10 650 778 1
6 PDO2 CANopen Slave 30 798 670 1
7 SDO Manual Master 0 385 513 1
8 SDO CANopen Master 10 1418 1546 1
9 PDO2 CANopen Slave 40 808 680 1
10 PDO1 Manual Master 0 385 513 1
11 PDO1 Manual Master 0 385 513 1
12 PDO1 Manual Master 0 385 513 1
13 PDO1 Manual Master 0 385 513 1
14 PDO1 Manual Master 0 385 513 1
15 PDO1 Manual Master 0 385 513 1

Figure 5-31 Communication relations for CAN

#### 5.12.6.1.9 Terminal Module Number

In CANopen mode, the assignment of the identifiers for the request and response objects are computed based on the module number.

Table 5-192 Terminal module numberr

| Configurable Values | Default Value |
|---|---|
| 0 to 127 | 1 |

#### 5.12.6.1.10 Communication Over

This parameter specifies if the communication relation is to be handled using PDOs or SDOs.

Table 5-193 Communication over

| Configurable Values | Default Value |
|---|---|
| PDO1 | X |
| PDO2 | |
| SDO | |

#### 5.12.6.1.11 Identifier Settings

In CANopen mode, the identifiers are assigned automatically. If this mode is not used, you need to assign values for the request and response identifier manually.

**Mode**

This parameter indicates whether you want to enter the identifier values manually or want the values to be computed automatically in accordance with the CANopen default values.

Table 5-194 Mode

| Configurable Values | Default Value |
|---|---|
| Manual | X |
| CANopen | |

**Connected with**

This parameter specifies whether the TesiMod operating device communicates with a master or with a slave. Based on this information, the values for the request and response identifiers are swapped. This parameter is only available if the CANopen mode has been selected.

Table 5-195 Connected with

| Configurable Values | Default Value |
|---|---|
| Master | X |
| Slave | |

**Module number**

This parameter specifies the slave's module number for a communication relation in the CANopen mode. To be able to change the module number, the CANopen mode must have been selected.

Table 5-196 Module number

| Configurable Values | Default Value |
|---|---|
| 0 to 127 | 0 |

**Identifier**

In the CANopen mode, the identifier values for request and response objects are computed automatically. In Manual mode, you need to enter the values manually.

Table 5-197 Identifier

| Configurable Values | Default Value |
|---|---|
| 0 to 65535 | 385 (Request), 513 (Response) |

**Default address type in bytes**

This parameter specifies the access type used to access the addresses of the communication partner. This parameter is relevant for PDO communication relations only.

Table 5-198 Default address type in bytes

| Configurable Values | Default Value |
|---|---|
| 1 (Byte) | X |
| 2 (Word) | |
| 3 (Double-word) | |

#### 5.12.6.2 System Parameters

##### 5.12.6.2.1 Poll Area via PDO Channel

For the poll area, specify whether you want to use one or three variables for this purpose.

Restrictions regarding the poll area with 1 variable:

– The variables must be byte-oriented or word-oriented.
– The area must be contiguous.
– The controller must be able to access this area in bit-mode.
– The operating device must be able to access this area in word-mode.

Restrictions regarding the poll area with 3 variables:

– The variables must be byte-oriented or word-oriented.
– The area for the single variable LED Control must be contiguous.
– The controller must be able to access these areas in bit-mode.
– The operating device must be able to access these areas in word-mode.

Table 5-199 Word-oriented polling area - CAN

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word address + 0 | Index 100 Subindex 0 | Write coordination byte | Reserved |
| Word address + 1 | Index 100 Subindex 2 | Message channel high-byte | Message channel low-byte |
| Word address + 2 | Index 100 Subindex 4 | Function key LEDs 1 to 4 | Function key LEDs 5 to 8 |
| Word address + 3 | Index 100 Subindex 6 | Function key LEDs 9 to 12 | Function key LEDs 13 to 16 |
| Word address + 4 | Index 100 Subindex 8 | Function key LEDs 17 to 20 | Function key LEDs 21 to 24 |
| Word address + 5 | Index 100 Subindex 10 | Function key LEDs 25 to 28 | Function key LEDs 29 to 32 |

See chapter “Word-Oriented Polling Area“ on page 3-116.

#### 5.12.6.2.2 Poll Area via SDO Channel

You can define the poll area via SDO channel for one single variable only.

The data for the poll area must be created as a "segmented object" on the server for this object. The object for deleting the message number in the serial message channel must be created using the following subindex:

– Poll area is byte-oriented = subindex 2
– Poll area is word-oriented = subindex 1

#### 5.12.6.2.3 Parallel Message System via PDO Channel

The same principles that apply to the poll area apply to the data area for the parallel message system.

– The data area must be byte-oriented or word-oriented.
– A byte address can be accessed in byte-word or word-mode.
– A word address can be accessed in word-mode only.

#### 5.12.6.2.4 Parallel Message System via SDO Channel

The data for the parallel message system must be created as a "segmented object" on the server for this object.

#### 5.12.6.2.5 Strings via the SDO Channel

Strings must be created as a "segmented object". The size of strings can not exceed 48 bytes.

#### 5.12.6.2.6 Tables via the SDO Channel

Data objects to be displayed as tables must be created on the server as an "array". The individual elements of an array are accessed via the subindex of the object.

Each subindex points to one element in the table. The table can contain 256 elements as a byte, word or double-word.

#### 5.12.6.3 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

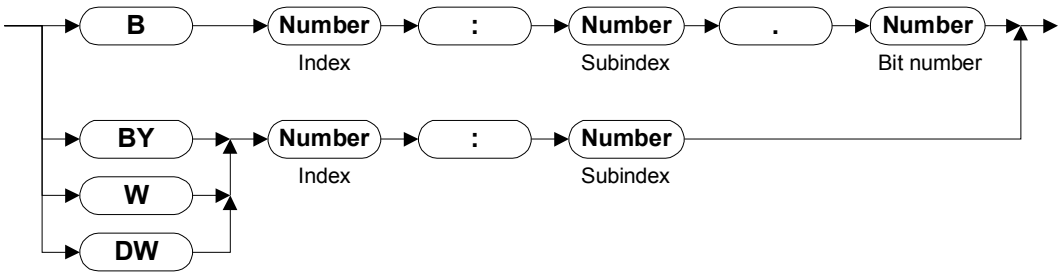



Figure 5-32 Syntax diagram

## 5.12.7 Physical Interfacing

The TesiMod operating devices to be connected to the CAN bus are equipped with interfaces complying with the CiA Draft Standard 102. All signal lines are jumpered from connector X2.1 to connector X2.2.

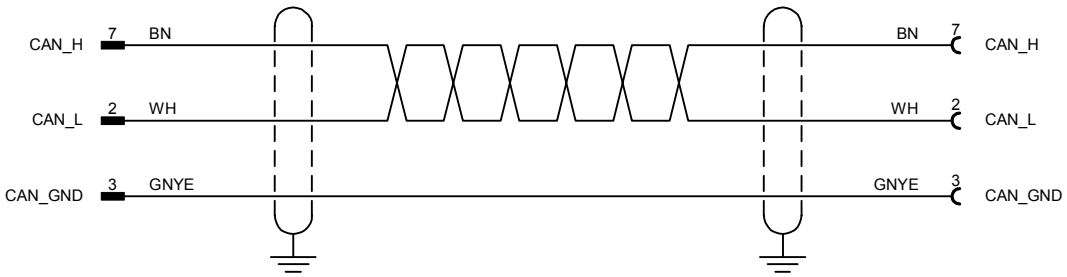
Table 5-200 Pin assignment X2.1 / X2.2 CAN bus

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | CAN_L | CAN_L Bus Line (Dominant LOW) |
| 3 | CAN_GND | CAN Ground |
| 4 | nc | Not Connected |
| 5 | nc | Not Connected |
| 6 | CAN_GND | CAN Ground |
| 7 | CAN_H | CAN_H Bus Line (Dominant HIGH) |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

### 5.12.7.1 Cable X2 - CAN

**Operating device**

**Next CAN bus station**




D-SUB
male connector
9 pin

D-SUB
female connector
9 pin

### 5.12.8 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-201 CAN error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave is currently not ready | |
| 2 | | Packets out of sequence | |
| 3 | | Protocol framing error | |
| 4 | | Timeout | |
| 5 | | CRC error | |
| 6 | | Parity error | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Buffer too small for cyclic data | |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | The selected protocol is not supported | |
| 16 | | Receive buffer overrun | |
| 40 | | Undefined system variable | |
| 50 | | Error from CAN controllerError number is stated in subcode | |
| | 1 | Stuff error | |
| | 3 | Operating device has no connection to bus | No stations are connected to the bus. |
| | 4, 5 | Bus error | Bus line has short-circuit to logical 0 or 1 |
| | 6 | CRC error | |
| 51 | | No response from communication partner | No partner for request object or response object. No recipient for transferred identifier. |
| | xx | Identifier, where the error occurred. | |
| 53 | | Wrong response object | Message without response bit (PDO) |
| | xx | Identifier, where the error occurred | |

Table 5-201 CAN error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 54 | | Wrong response object | Response without request |
| | xx | Identifier, where the error occurred | |
| 55 | | Operating device can not find CAN hardware. | CAN hardware in operating device is defective |
| | 0 | | |
| 60 | | NMT 0 message from master with module reset (129) | |
| | 0 | | |
| 100 | | Error from communication partnerError number is stated in subcode | |
| | xx | Error number from communication partner - freely definable | |
| System errors | | | |
| 1283 | | Parameter inconsistent. Toggle bit does not change | |
| 1284 | | Waiting time has elapsed | |
| 1537 | | Write access to read-only object | |
| 1538 | | Object does not exist | |
| 1542 | | Error during access due to a hardware error | |
| 1543 | | Data type conflict | |
| 1545 | | Subindex does not exist | |
| 2048 | | Other error | |

## 5.12.9 Applications

### 5.12.9.1 Examples for Communication Relations

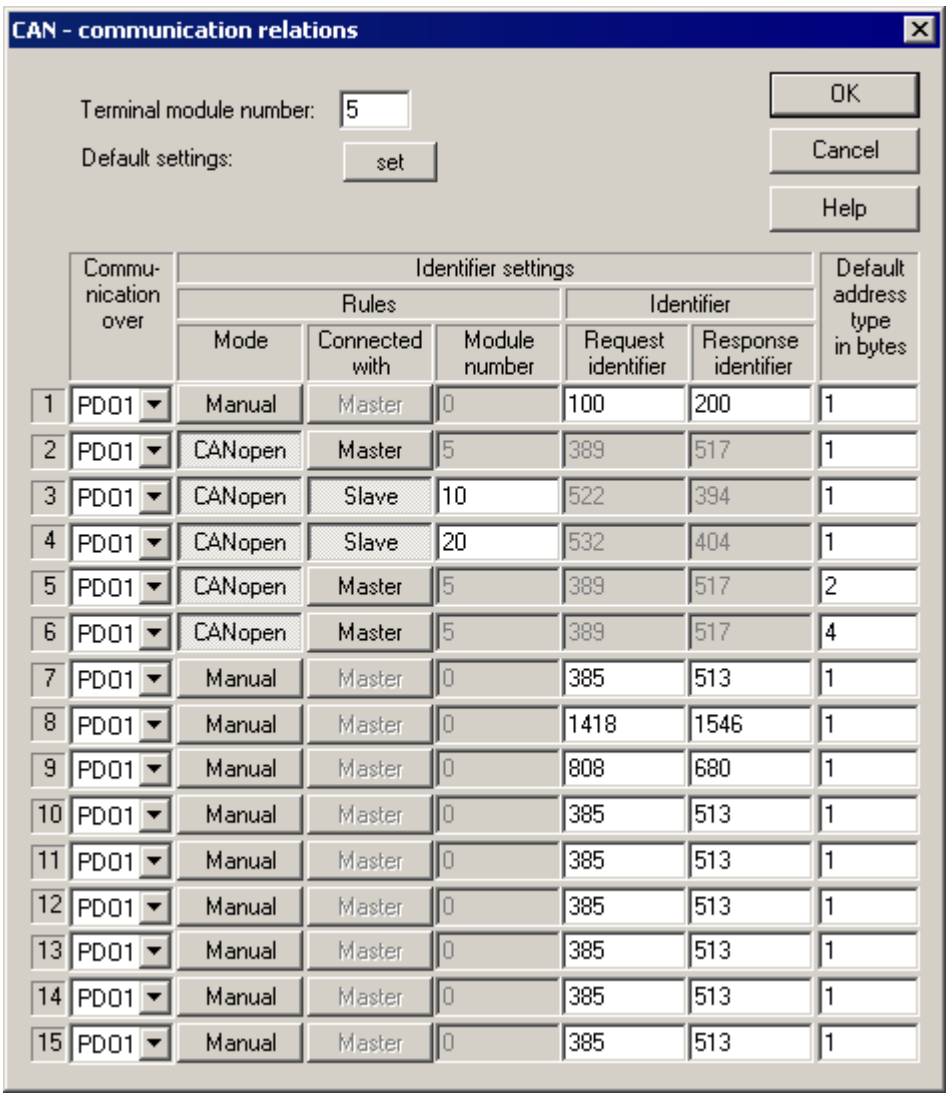
With TSwin, you can define up to 15 communication relations. Carry out the following steps to open the table for the communication relations:

1. In the main window of TSwin, select the **Controllers**tab.
2. Select the **Communication parameters** option from the left list box.
3. Click the **Edit** button.

The **Protocol parameters CAN** window appears.

4. Click the **Communication relations**button.

The **CAN Communication relations** window opens.




| | Commu-nication over | Identifier settings | | | | | Default address type in bytes |
|---|---|---|---|---|---|---|---|
| | | Rules | | | Identifier | | |
| | | Mode | Connected with | Module number | Request identifier | Response identifier | |
| 1 | PDO1 | Manual | Master | 0 | 100 | 200 | 1 |
| 2 | PDO1 | CANopen | Master | 5 | 389 | 517 | 1 |
| 3 | PDO1 | CANopen | Slave | 10 | 522 | 394 | 1 |
| 4 | PDO1 | CANopen | Slave | 20 | 532 | 404 | 1 |
| 5 | PDO1 | CANopen | Master | 5 | 389 | 517 | 2 |
| 6 | PDO1 | CANopen | Master | 5 | 389 | 517 | 4 |
| 7 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |
| 8 | PDO1 | Manual | Master | 0 | 1418 | 1546 | 1 |
| 9 | PDO1 | Manual | Master | 0 | 808 | 680 | 1 |
| 10 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |
| 11 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |
| 12 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |
| 13 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |
| 14 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |
| 15 | PDO1 | Manual | Master | 0 | 385 | 513 | 1 |

Figure 5-33 Communication relations for CAN

Below see an example of a variable list with sample variables for these communication relations.

Table 5-202 Variable list for CAN

| No. | Variable name | Address | Comm. Relation.: |
|---|---|---|---|
| 0 | Var1 | B 0:1.3 | 1 |
| 1 | Var2 | B 100:10.12 | 5 |
| 2 | Var3 | B 100:10.12 | 1 / 2 |
| 3 | Var4 | BY 1:35 | 1 |
| 4 | Var5 | BY 10:78 | 1 |
| 5 | Var6 | W 11:24 | 1 |
| 6 | Var7 | W 100:102 | 5 |
| 7 | Var8 | W 130:12 | 1 / 2 |
| 8 | Var9 | DW 100:102 | 5 |
| 9 | Var10 | DW 130:20 | 1 / 2 |
| 10 | Var11 | DW 50:25 | 6 |
| 11 | Var12 | DW 200:20 | 1 / 4 |

**Explanation of the addresses**

The following applies to the communication relation 1:

– Index 0 to 99 is byte-oriented
– Index 100 to 199 is word-oriented
– Index 200 to 300 is double-word oriented.

Table 5-203 Explanation of the addresses

| Variable Name | Access | Index | Sub-index | Bit Number | Communication Relation | Address Type |
|---|---|---|---|---|---|---|
| Var1 | Bit | 0 | 1 | 3 | 1 | |
| Bit access: Bit 3 of index 0, subindex 1 of communication relation 1<br>If no address type is entered, the default value in the communication relation definition table applies. In this case, no specified address type means = byte address. | | | | | | |
| Var3 | Bit | 100 | 10 | 12 | 1 | 2 |
| Bit access: Bit 12 of index 100, subindex 10 of communication relation 1<br>Index 100 in the communication relation 1 is a word address. However, the default setting is "Byte address". Therefore, a "2" must be entered here for the address type. | | | | | | |
| Var2 | Bit | 100 | 10 | 12 | 5 | |
| Bit access: Bit 12 of index 100, subindex 10 of communication relation 5 | | | | | | |
| Var5 | Byte | 10 | 78 | | 1 | |
| Byte access: Index 10, subindex 78, communication relation 1 | | | | | | |
| Var8 | Word | 130 | 12 | | 1 | 2 |
| Word access: Index 130, subindex 12, communication relation 1<br>Index 100 to 199 in communication relation 1 is a word address. However, the default setting is "Byte address". Therefore, a "2" must be entered here for the address type. | | | | | | |

Table 5-203 Explanation of the addresses

| Variable Name | Access | Index | Sub-index | Bit Number | Communication Relation | Address Type |
|---|---|---|---|---|---|---|
| Var12 | Double word | 200 | 20 | 3 | 1 | 4 |
| Double-word access: Index 200, subindex 20, communication relation 1<br>Index 200 to 300 in communication relation 1 is a double-word address. However, the default setting is "Byte address". Therefore, a "4" must be entered for the address type. | | | | | | |
| Var11 | Double word | 50 | 25 | | 6 | |
| Double-word access: Index 50, subindex 25, communication relation 6 | | | | | | |

# 5.13 DeviceNet

The operating device is incorporated into the DeviceNet network as a DeviceNet slave. The communication between a controller (master or scanner) and the operating device (slave) is based on the Predefined Master/Slave Connection Set.

Explicit Message Connections and Poll I/O Connections are used as Connection Instances.

## 5.13.1 Explicit Message

Explicit Messages are used to exchange data between the operating device and the controller. This requires you to create a function block in the controller which assembles the payload into Explicit Messages.

### 5.13.1.1 Storing Data

All data displayed by the operating device are stored in the operating device's data memory.

The size of the data memory is 2500 words.

The data memory is word-oriented. The addresses are always word addresses, both from the operating device's and the controller's perspective.

### 5.13.1.2 Exchanging Data

You need to create a program (function block) in the controller which is used to establish a data exchange between the operating device and the controller by means of Explicit Messages. For this, make sure that the data on both devices are consistent.

You can carry out the data exchange cyclically or carry it out event-controlled through the controller using the I/O Poll Telegram.

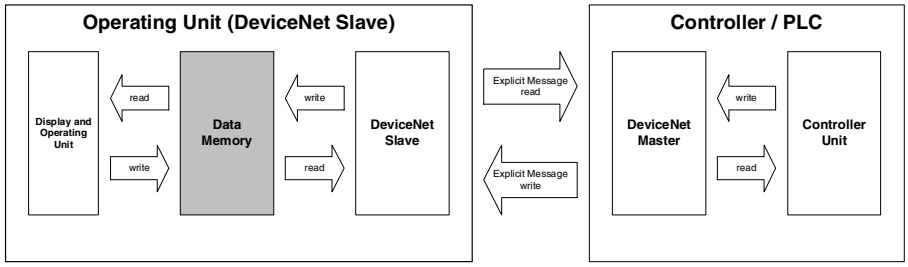



Figure 5-34 Data exchange, DeviceNet

### 5.13.1.3 Data Memory

The data memory in the operating device is referred to as the Memory Object.

The Memory Object Address has the following values.

Table 5-204 Memory object addresses

| Address | Name | Comment |
|---|---|---|
| 0x8A | Class ID | |
| 0x01 | Instance ID | |
| 0x01 | Attribute | Not required |

The service

– for a read access is 0x33 and
– for a write access is 0x35.

#### 5.13.1.4 Read Service

The following table illustrates the structure of the Explicit Message for the Read service. Each field of the telegram is one byte long.

Table 5-205 Structure of the Explicit Message for the Read service

| Byte | Request telegram | Response telegram |
|---|---|---|
| 1 | MAC ID | MAC ID |
| 2 | Service ID<br>0x33 | Service ID<br>0xB3 |
| 3 | Class ID<br>0x8A | 1st Data Word<br>Low Byte |
| 4 | Instance ID<br>0x01 | 1st Data Word<br>High Byte |
| 5 | Word Address<br>Low Byte | 2nd Data Word<br>Low Byte |
| 6 | Word Address<br>High Byte | 2nd Data Word<br>High Byte |
| 7 | Number of Bytes<br>Low Byte | |
| 8 | Number of Bytes<br>High Byte | |

The word address corresponds to the offset within the data memory in the operating device.

The byte order for the

– word address,
– number of bytes and
– data word

can be specified in the communication parameters.

See chapter “Byte Order“ on page 5-189.

#### 5.13.1.5 Write Service

The following table illustrates the structure of the Explicit Message for the Write service. Each field of the telegram is one byte long.

Table 5-206 Structure of the Explicit Message for the Write service

| Byte | Request Telegram | Response Telegram |
|---|---|---|
| 1 | MAC ID | MAC ID |
| 2 | Service ID<br>0x35 | Service ID<br>0xB5 |
| 3 | Class ID<br>0x8A | |
| 4 | Instance ID<br>0x01 | |
| 5 | Word Address<br>Low Byte | |
| 6 | Word Address<br>High Byte | |
| 7 | 1st Data Word<br>Low Byte | |
| 8 | 1st Data Word<br>High Byte | |
| 9 | 2nd Data Word<br>Low Byte | |
| 10 | 2nd Data Word<br>High Byte | |

The word address corresponds to the offset within the data memory in the operating device.

The byte order for the

- word address,
- number of bytes and
- data word

can be specified in the communication parameters.

See chapter “Byte Order“ on page 5-189.

#### 5.13.1.6 Fragmentation

By means of fragmentation, up to 384 bytes can be transferred in one explicit message.

## 5.13.2 Poll I/O Connection

The Poll I/O Connection can be used for event-controlled exchange of data between the master and the slave.

On account of the EDS data, the Poll I/O Connection is installed automatically between the DeviceNet master and the operating device. With this connection, 2 bytes are transferred cyclically from the controller's OUT area to the operating device and 5 bytes are transferred from the operating device to the IN area of the controller.

### 5.13.2.1 Receive Data of the Operating Device (Consumed Data)

The Consumed Connection Size is 2 bytes.

Table 5-207 Structure of the Consumed Data

| Byte | Designation |
|---|---|
| 1 | Initialization |
| 2 | Control Byte |

### 5.13.2.2 Transmit Data of the Operating Device (Produced Data)

The Produced Connection size is 5 bytes.

Table 5-208 Structure of the Produced Data

| Byte | Designation |
|---|---|
| 1 | Initialization |
| 2 | Control Byte |
| 3 | Word Address - Low Byte |
| 4 | Word Address - High Byte |
| 5 | Number of Altered Bytes |

#### 5.13.2.2.1 Byte 1 - Initialization

During the boot process, the operating device writes the value 0x00 into its Produced Data. Thus, the controller needs to initialize the entire data memory in the operating device once.

Initialization means that all variable values in the data memory of the operating device are set the same as in the controller. When this process is completed, the controller writes the value 0xC3 into the Consumed Data.

The operating device acknowledges by writing the value 0xC3 into the Produced Data.

After the boot process, the operating device waits for the initialization to complete, before it accesses the data memory. If the initialization is not performed within the time period set for the Delay until Connection Set-Up, the message WAIT FOR INITIZING OF DATA-MEMORY BY MASTER is displayed on the operating device.

To remove the message, press the Help key or a key that calls up another mask.

#### 5.13.2.2.2 Byte 2 - Control Byte

During initialization, the control byte is set to the value 0x00.

**Bit 0** Bit 0 is the toggle bit.

After you change a variable on the operating device, bit 0 in the Produced Data toggles.

If the controller detects that bit 0 in the Produced Data and bit 0 in the Consumed Data do not match, the controller reads the variable.

Once the read operation is complete, the controller sets the value of bit 0 in the Consumed Data to the same value as that of bit 0 in the Produced Data.

If the controller detects that bit 0 in the Produced Data and bit 0 in the Consumed Data differ, bit 0 in the Consumed Data must be set to the same value as that of bit 0 in the Produced Data!
This also applies if cyclic data exchange is used.

If no bit synchronization takes place, the operating device displays the error message Timeout Error: Code 60, Subcode1“.

**Bit 1 to bit 7** Bits 1 to 7 are reserved.

#### 5.13.2.2.3 Byte 3 and Byte 4 - Word Address

Bytes 3 and 4 in the Produced Data contain the word address starting from which a variable has changed. The variable can be several bytes long. The controller uses this word address to selectively read the changed variable from the data memory of the operating device.

#### 5.13.2.2.4 Byte 5 - Number of Bytes

Byte 5 in the Produced Data contains the number of bytes as the size information for the changed variable.

### 5.13.2.3 Module /Network Status

The operating devices are not equipped with diagnostic LEDs for DeviceNet status indication.

To indicate the module/network status, use the system variable ComBaudrateA instead.

See chapter “ComBaudrateA“ on page 3-48.

## 5.13.3 Programming

### 5.13.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.13.3.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-209 Baud rate

| Configurable Values (kBaud) | Default Value |
|---|---|
| 125 | X |
| 250 | |
| 500 | |

#### 5.13.3.1.2 Node Number

Use the node number to set the MAC ID for the operating device.

Table 5-210 Node number

| Configurable Values | Default Value |
|---|---|
| 0 to 63 | 0 |

#### 5.13.3.1.3 Delay until Connection Set-Up

Specify this value to set the period of time the operating device waits before it sends the first Duplicate MAC ID Check Request Message. Messages arriving before this time has elapsed are not evaluated.

Table 5-211 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.13.3.1.4 Waiting Time for Response

Specify a waiting time for the Produced Data toggle bit monitoring.

Table 5-212 Waiting time for response

| Configurable Values | Default Value |
|---|---|
| 0 ms, 50 ms to 65000 ms | 500 ms |

See chapter “Byte 2 - Control Byte“ on page 5-186.

#### 5.13.3.1.5 Attribute

The Attribute parameter is not required in the Explicit Message to access the Memory Object. Some controllers do, however, force and transfer the Attribute parameter to generate an Explicit Message.

In this case, select the check box: Explicit Message Contains the Parameter 'Attribute'.

Table 5-213 Explicit Message contains the Attribute parameter

| Configurable Values | Default Value |
|---|---|
| OFF | |
| ON | X |

#### 5.13.3.1.6 Byte Order

The byte order for the DeviceNet protocol is Low-High.

See Appendix J in Volume 1 of the DeviceNet Specification.

The experience of some users has shown that some controllers do not use this byte order. In these cases, a byte-swap must be performed in the controller. For ease of programming, the user also has the option of swapping the byte order in the operating device.

Select two selection fields depending on the actual byte order:

Table 5-214 Byte order

| Configurable Values | Default Value |
|---|---|
| Address/Length Low-High | X |
| Data Low-High | X |
| Address/Length High-Low | |
| Data High-Low | |

#### 5.13.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

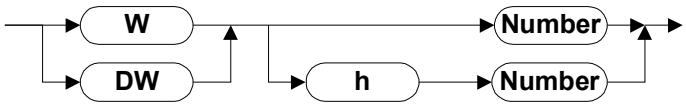



Figure 5-35 Syntax diagram for DeviceNet

#### 5.13.3.3 Variables

The variable addresses specify an offset in the data memory of the operating device.

Table 5-215 Addresses in the data memory of the operating device

| Variable name | Address | Low Byte | High Byte |
|---|---|---|---|
| Word Access to Address 127 | W 127 | | |
| Word Access to the Highest Address | W 2500 | | |
| Double-Word Access to Address 371 | DW 371 | | |
| Double-Word Access to the Highest Address | DW 2499 | | |
| Bit Access to Bit 5 in Address 500 | W 500 | 5 | 5 |
| Bit Field Access to Bit 3 - Bit 12 in Address 1500 | W 1500 | 3 | 12 |

#### 5.13.3.4 System Variables

Since the operating devices do not have diagnostic LEDs, you need to use system variables to indicate specific DeviceNet statuses. You can create these system variables within any mask as output variables. To do so, select the representation type Selection Text and link the variable with a text list containing a text string for each status.

##### 5.13.3.4.1 ComBaudrateA

This system variable can be used to indicate the statuses of the module/network LED.

Table 5-216 Statuses of the module/network LED

| Value | Text | Meaning |
|---|---|---|
| 0 | LED Off | |
| 1 | LED Green | Device is assigned |
| 2 | LED flashes green | DUP_MAC_ID test is OK but a connection has not been established |
| 3 | LED Flashes Red | Connection terminated after a time delay |
| 4 | LED Red | BUS-OFF status |
| 5 | LED flashes red and green | DUP_MAC_ID error |

#### 5.13.3.4.2 ComHandshakeA

This system variable allows you to indicate whether the data memory has been initialized by the master.

See chapter “Byte 1 - Initialization“ on page 5-186.

Table 5-217 Initialization states of the data memory

| Value | Status |
|---|---|
| 0 | Not initialized |
| 1 | Initialized |

## 5.13.4 Object Definitions

Table 5-218 Object definitions

| Class ID | Object Name |
|---|---|
| 0x01 | Identity Object |
| 0x02 | Message Router (not supported) |
| 0x03 | DeviceNet Object |
| 0x04 | Assembly Object (not supported) |
| 0x05 | Connection Object |
| 0x8A | BT Object |

### 5.13.4.1 Identity Object

#### 5.13.4.1.1 Instance Attribute

Table 5-219 Instance Attribute of the Identity Object

| Attribute ID | Attribute Name | Access Rule | Data Size (Byte) | Attribute Value |
|---|---|---|---|---|
| 0x01 | Vendor ID | Get | 2 (6-2.2) | 0x238 |
| 0x02 | Device Type | Get | 2 | 0x00 |
| 0x03 | Product Code | Get | 2 | 0x01 |
| 0x04 | Revision | Get | 2 | 0x0101 (1.001) |
| 0x05 | Status | Get | 2 | |
| 0x06 | Serial Number | Get | 4 | 0x01 |
| 0x07 | Product Name | Get | 32 | DeviceNet for BT series |

#### 5.13.4.1.2 Instance Service

Table 5-220 Instance Service of the Identity Object

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Returns the Contents of the Specific Attribute |
| 0x05 | Reset | Invoke the Reset Service in the BT |

#### 5.13.4.1.3 Message Router Object

This object is not supported.

### 5.13.4.2 DeviceNet Object

#### 5.13.4.2.1 Class Service

Table 5-221 Class Service of the DeviceNet Object

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read Attribute |

#### 5.13.4.2.2 Instance Attribute

Table 5-222 Instance Attribute of the DeviceNet Object

| Attribute ID | Attribute Name | Access Rule | Data Size (Byte) |
|---|---|---|---|
| 0x01 | MAC ID | Get | 1 |
| 0x02 | BaudRate | Get | 1 |

#### 5.13.4.2.3 Instance Service

Table 5-223 Instance Service of the Identity Object

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Returns the Contents of the Specific Attribute |
| 0x05 | Reset | Invoke the Reset Service in the BT |

### 5.13.4.3 Assembly Object

This object is not supported.

### 5.13.4.4 Connection Object

#### 5.13.4.4.1 Class Service

Table 5-224 Class Service of the Connection Object

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read Attribute |

#### 5.13.4.4.2 Instance Attribute

Table 5-225 Instance Attribute of the Connection Object

| Attribute ID | Attribute Name | Access Rule | Data Size (Byte) | Value Expl. | Value IO-Poll |
|---|---|---|---|---|---|
| 0x01 | State | Get | 1 | 3 | 1 |
| 0x02 | Instance Type | Get | 1 | 0 | 1 |
| 0x03 | TransportClass_Trigger | Get | 1 | 0x38 | 0x82 |
| 0x04 | Produced Connection ID | Get | 2 | | |
| 0x05 | Consumer Connection ID | Get | 2 | | |
| 0x06 | Initial Comm Characteristics | Get | 1 | 0x21 | 0x01 |
| 0x07 | Produced Connection Size | Get | 2 | | 5 |
| 0x08 | Consumed Connection Size | Get | 2 | | 2 |
| 0x09 | Expected Packed Rate | Get/Set | 2 | 0x9C4 | 0 |
| 0x0C | Watchdog TimeoutAction | Get | 1 | 3 | 0 |
| 0x0D | Produced Connection Path Length | Get | 2 | 0 | 0 |
| 0x0E | Produced Connection Length | Get | 6 | | |
| 0x0F | Consumed Connection Path Length | Get | 2 | 0 | 0 |
| 0x10 | Consumed Connection Path | Get | 6 | | 0 |

#### 5.13.4.4.3 Instance Service

Table 5-226 Instance Service of the Connection Object

| Service ID | Service Name | Description |
|---|---|---|
| 0x0E | Get_Attribute_Single | Read Attribute |
| 0x10 | Set_Attribute_Single | Write Attribute |

#### 5.13.4.4.4 BT Object

#### 5.13.4.4.5 Instance Service

Table 5-227 Instance Service of the BT Object

| Service ID | Service Name | Description |
|---|---|---|
| 0x33 | Block StringN Read | Read Data by Each Data Unit |
| 0x35 | Block StringN Write | Write Data by Each Data Unit |

**Service ID = 0x33 (Block StringN Read)**

Table 5-228 Request without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x33) |
| 3 | Class ID (0x8A) |

Table 5-228 Request without Attribute parameter

| Byte | Designation |
|---|---|
| 4 | Instance ID (0x01) |
| 5 | Word Address Low Byte * |
| 6 | Word Address High Byte * |
| 7 | Word Number of Bytes Low Byte * |
| 8 | Word Number of Bytes High Byte * |

Table 5-229 Response without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB3) |
| 3 | 1st Data Word Low Byte ** |
| 4 | 1st Data Word High Byte ** |
| 5 | 2. Data Word Low Byte ** |
| 6 | 2nd Data Word High Byte ** |

Table 5-230 Request with Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x33) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Attribute (0x01) |
| 6 | Word Address Low Byte * |
| 7 | Word Address High Byte * |
| 8 | Word Number of Bytes Low Byte * |
| 9 | Word Number of Bytes High Byte * |

Table 5-231 Response with Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB3) |
| 3 | 1st Data Word Low Byte ** |
| 4 | 1st Data Word High Byte ** |
| 5 | 2nd Data Word Low Byte ** |
| 6 | 2nd Data Word High Byte ** |

**Service ID = 0x35**
**(Block StringN Write)**

Table 5-232 Request without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x35) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Word Address Low Byte * |
| 6 | Word Address High Byte * |
| 7 | 1st Data Word Low Byte ** |
| 8 | 1st Data Word High Byte ** |
| 9 | 2nd Data Word Low Byte ** |
| 10 | 2nd Data Word High Byte ** |

Table 5-233 Response without Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB5) |

Table 5-234 Request with Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0x35) |
| 3 | Class ID (0x8A) |
| 4 | Instance ID (0x01) |
| 5 | Attribute (0x01) |
| 6 | Word Address Low Byte * |
| 7 | Word Address High Byte * |
| 8 | 1st Data Word Low Byte ** |
| 9 | 1. Data Word High Byte ** |
| 10 | 2nd Data Word Low Byte ** |
| 11 | 2. Data Word High Byte ** |

Table 5-235 Response with Attribute parameter

| Byte | Designation |
|---|---|
| 1 | MAC ID |
| 2 | Service ID (0xB5) |

* Depends on the protocol parameter Byte Order for Address/Length.

** Depends on the protocol parameter Byte Order for Data.

See chapter “Byte Order“ on page 5-189.

### 5.13.5 Format of the Explicit Message High Byte

Table 5-236 Format of the Explicit Message

| Class ID (1 Byte) | Service ID (1 Byte) | Instance ID (1 Byte) | Service Data | | Service Name |
|---|---|---|---|---|---|
| | | | Attribute ID (1 Byte) | Data (n Byte) | |
| 0x01 (Identity Object) | | 0x01 | 0x01 | Vendor ID | Get Attribute SingleVendor ID |
| | | | 0x02 | Product Type | Get Attribute SingleProduct Type |
| | | | 0x03 | Product Code | Get Attribute SingleProduct Code |
| | | | 0x04 | VendorRevi-sion | Get Attribute SingleVendor Revision |
| | | | 0x05 | ID Status | Get Attribute SingleID Status |
| | | | 0x06 | Serial Num-ber | Get Attribute SingleSerial Number |
| | | | 0x07 | Product Name | Get Attribute SingleProduct Name |
| | 0x05 | | N/A or 0x01 | | RESET |
| 0x03 (De-viceNet Object) | 0x0E (Get) | 0x01 | 0x01 | MAC ID | Get Attribute Single MAC ID |
| | | | 0x02 | Baud Rate | Get Attribute SingleBaud Rate |
| | | | 0x03 | BOI | Get Attribute Single BOI |
| | | | 0x04 | Bus Off Counter | Get Attribute SingleBus Off Counter |
| | | | 0x05 | AllocationIn-formation | Get Attribute SingleAllocation Information |

Table 5-236 Format of the Explicit Message

| Class ID (1 Byte) | Service ID (1 Byte) | Instance ID (1 Byte) | Service Data | | Service Name |
|---|---|---|---|---|---|
| | | | Attribute ID (1 Byte) | Data (n Byte) | |
| 0x05 (Connection Object) | 0x0E (Get) | 0x01 (Explicit Message)<br>0x02 (Polled I/O)<br>0x03 (Bit Strobed I/O) | 0x01 | State | Get Attribute Single State |
| | 0x02 | Instance Type | Get Attribute SingleInstance Type | | |
| | 0x03 | Transport Class Trigger | Get Attribute SingleTransport Class Trigger | | |
| | 0x04 | Produced Connection ID | Get Attribute SingleProduced Connection ID | | |
| | 0x05 | Consumed Connection ID | Get Attribute SingleConsumed Connection ID | | |
| | 0x06 | Initial Comm. Characteristics | Get Attribute Single Initial Comm. Characteristics | | |
| | 0x07 | Produced Connection Size | Get Attribute SingleProduced Connection Size | | |
| | 0x08 | Consumed Connection Size | Get Attribute SingleConsumed Connection Size | | |
| | 0x09 | Expected Packet Rate | Get Attribute SingleExpected Packet Rate | | |
| | 0x0C | Watchdog TimeoutAction | Get Attribute Single-Watchdog Timeout Action | | |
| | 0x0D | Produced Connection Path Length | Get Attribute SingleProduced Connection Path Length | | |
| | 0x0E | Produced Connection Path | Get Attribute SingleProduced Connection Path | | |



SUTRON ELECTRONIC GMBH

Table 5-236 Format of the Explicit Message

| Class ID (1 Byte) | Service ID (1 Byte) | Instance ID (1 Byte) | Service Data | | Service Name |
|---|---|---|---|---|---|
| | | | Attribute ID (1 Byte) | Data (n Byte) | |
| 0x8A (Memory Object) | 0x33 (Read) | 0x01 | 0x01 | Service Data | Block String Read |
| | 0x35 (Write) | 0x01 | 0x01 | Service Data | Block String Write |

### 5.13.6 EDS File

The EDS file ensures that the Poll I/O Connection is automatically installed between the DeviceNet master and operating device.

### 5.13.7 Physical Interfacing

Plug-in connectors on the operating device for connection to the DeviceNet bus.

Table 5-237 Pin assignment X2.1 / X2.2 CAN bus

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | CAN_L | CAN_L Bus Line (Dominant LOW) |
| 3 | CAN_GND | CAN Ground |
| 4 | nc | Not Connected |
| 5 | nc | Not Connected |
| 6 | CAN_GND | CAN Ground |
| 7 | CAN_H | CAN_H Bus Line (Dominant HIGH) |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

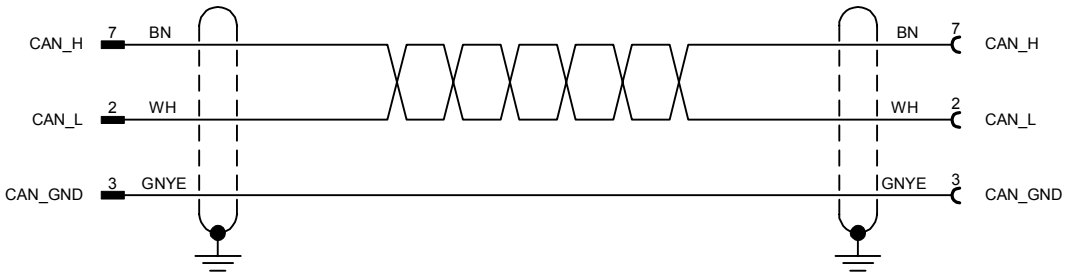
For the connection to the bus, use twisted pair, shielded cables only. Terminate both ends of the bus with terminating resistors.

All signal lines in the operating device are bridged from X2.1 to X2.2. Connect the connecting cables to all pins, including the reserved pins. This allows continued use of the cables, even if the bus specification is extended in the future.

#### 5.13.7.1 Cable X2.1 / X2.2 - DeviceNet

Operating device

Next DeviceNet participant




D-SUB
male connector
9 pin

D-SUB
female connector
9 pin

Both ends of the shield are connected to the metallic housing.

Contrary to the recommendations made in the CiA Draft Standard 102, the cable is only equipped with the wires needed to meet the current communication requirements.

### 5.13.8 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-238 DeviceNet error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Hardware error | |
| | 1 | CAN controller error (stuff error) | |
| | 2 | CAN controller error (form error) | |
| | 3 | CAN controller error (acknowledge error) | Device is not connected to the bus. |
| | 4 | CAN controller error (bit 1 Error) | Short-circuit between the CAN_L and CAN_H line. |
| | 5 | CAN controller error (bit 0 error) | Short-circuit between the CAN_L and CAN_H line. |
| | 6 | Error from CAN controller (CRC error) | |
| 60 | | Data exchange error | |
| | 1 | Toggle bit in the control byte is not processed by the controller or the DeviceNet master. | If the controller detects that the toggle bit in the Produced Data and the toggle bit in the Consumed Data differ, the toggle bit in the Consumed Data must be set to the same value as that of the toggle bit in the Produced Data. |

## 5.13.9 Applications

### 5.13.9.1 Rockwell SLC 505 - 1747 SDN/B

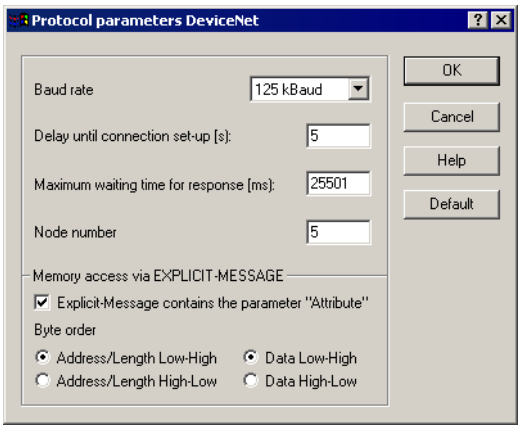



Figure 5-36 DeviceNet for Rockwell SLC 505-1747 SDN/B

### 5.13.9.2 OMRON DRM 21-V1

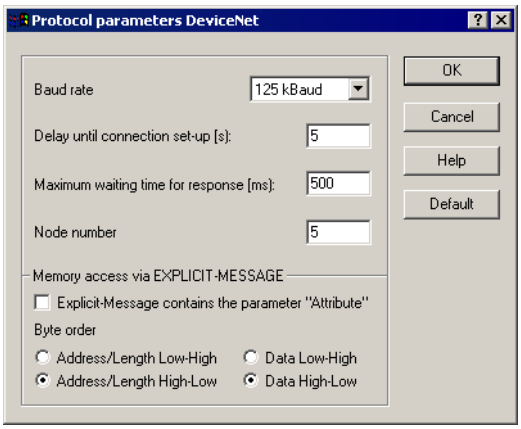



Figure 5-37 DeviceNet for OMRON DRM 21-V1

## 5.14 DIN Measurement Bus

You can connect a TesiMod operating device as a slave to a controller and then use this device as a gateway for other slaves in a DIN Measurement Bus.

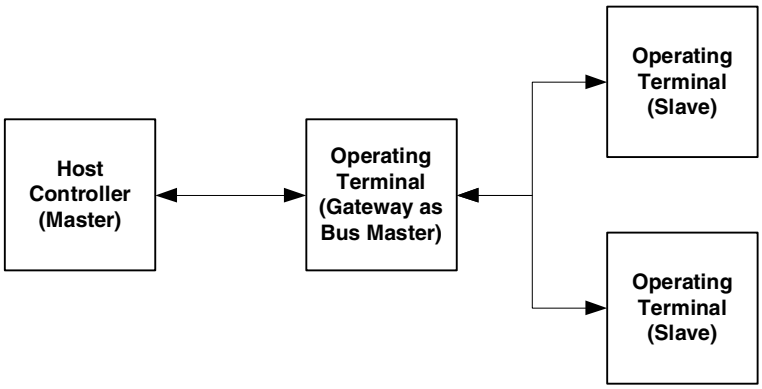



Figure 5-38 DIN Measurement Bus structure

When the operating device is connected to the controller (host computer) this is usually a point-to-point connection. In this case, the controller is the master and the operating device is the slave.

The operating device in turn acts as the gateway and bus master in the DIN Measurement Bus. You can connect additional TesiMod operating devices as slaves to this operating device.

A detailed description of the connection between the host computer and gateway is provided for each type of connection.

The firmware used in the TesiMod operating device that operates as the DIN Measurement Bus master differs from the firmware used in the connected TesiMod operating devices functioning as slaves.

### 5.14.1 DIN Measurement Bus Master

Any process computer can be used as a DIN Measurement Bus master, provided that it complies with the following requirements:

– Communication takes place according to DIN66348 part 2 (specifies data link layers 1 and 2 of the ISO/OSI layer model).
– Data contents interpreted as per Sütron TesiBus specifications.

The services (DIN Measurement Bus user data contents) are defined independently of addresses. A number of different address formats is provided for the connection. An internal Sütron address format is used for indirect PLC connections. Linear, byte-oriented memory addressing with an address space of 224 bits is used for general process computer connections.

If you choose to use a TesiMod operating device as a bus master, it offers the full range of functions of an operating device that manages connection to the controller using interface X2 and handles the DIN Measurement Bus protocol using interface X3.

This operating device therefore does not feature the following functions:

– Printout of messages, logs and so on
– Barcode scanner connection

When used as a gateway, the TesiMod operating device has the following additional functions not included with the standard operating device:

– Extended poll area
– Cache function for read-only data
– Network status image.

#### 5.14.1.1 Extended Poll Area

With the cyclic poll area, you can access the following functions on the master or slave operating device:

– Write coordination byte (WCB)
– Serial message channel
– Status LEDs for function keys

The function has been enhanced to offer more than the standard poll area for direct PLC connection. Rather than being statically mapped to the operating device functions, this poll area is event-controlled and transmitted for each specific slave by means of the trigger byte. In other words, the controller fills the poll area and then transfers it to the gateway using bit 7 (value 0x80) of the trigger byte. Once the function has been executed, the gateway writes the return value and the code 0x40 into the trigger byte. The controller then resumes control of the data area.

The poll area has the following set layout, which may be either byte-oriented or word-oriented, depending on the address specified:

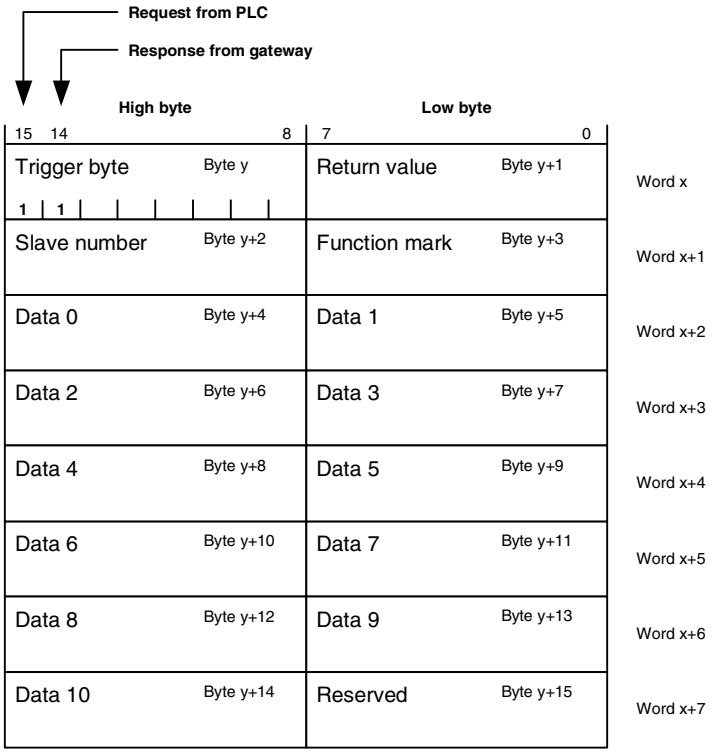



Figure 5-39 Structure of poll area for DIN Measurement Bus

Table 5-239 Function of the individual bytes

| Byte | Bit | Function |
|---|---|---|
| Slave Number | 0 | Data are intended for the gateway itself |
| | 1 to 31 | Slave number to which the event is transmitted by order-only |
| Function Code | 1 | Transfer new Write co-ordination byte |
| | 2 | Transmit message |
| | 3 | Activate/deactivate LEDs |
| Return Value | 0 | Ok-acknowledge signal |
| | 1 | Slave is not ready to receive |
| | 2 | General DIN Measurement Bus error |
| | 3 | Invalid function code |
| | 4 | Slave not synchronized |
| Function "Transmit new Write coordination byte (WCB)" | | |
| Data 0 | | WCB (Write coordination byte) |
| Data 1 | | Available |
| Function "Transmit message" | | |
| Data 0 | | Message number high byte |
| Data 1 | | Message number low byte |

Table 5-239 Function of the individual bytes

| Byte | Bit | Function |
|---|---|---|
| Function "Activate/deactivate LEDs" | | |
| Data 0 | | LED 1 to LED 4 |
| Data 1 | | LED 5 to LED 8 |
| Data 2 | | LED 9 to LED 12 |
| Data 3 | | LED 13 to LED 16 |
| Data 4 | | LED 17 to LED 20 |
| Data 5 | | LED 21 to LED 24 |
| Data 6 | | LED 25 to LED 28 |
| Data 7 | | LED 29 to LED 32 |
| Data 8 | | LED 33 to LED 36 |
| Data 9 | | LED 37 to LED 40 |
| Data 10 | | LED 41 to LED 44 |

#### 5.14.1.2 Cache Function for Read-Only Data

The cache function reads a memory area of up to 62 bytes from the PLC and broadcasts the information to all connected slaves at cyclic intervals. This greatly reduces the load on the bus and allows simultaneous transmission of the data to all operating devices.

The broadcast service on communication layer 2 is not monitored, therefore, the slaves implement a definable timeout to monitor receipt of the broadcasted data packets.

If a slave has a read request which is located within the cache area, no communication will be carried out via the gateway to the PLC, but the data will be copied locally from the cache of the gateway operating device.

Variables that are displayed once and which are located within the cache area, will be displayed once more after receipt of the next cache packet. The gateway operating device transmits the cache data in an equidistant fashion thus permitting a high-priority and speedy output which is independent of the general output cycle.

#### 5.14.1.3 Network Status

A 4-byte area is used by the gateway to transmit the status of the network to the PLC. Each slave which is detected on the network and which is synchronized is represented by a bit set to "1".

If a slave is being synchronized (i.e. its bit changes from "0" to "1"), the external data release for this slave will be reset and the function keys for this slave will be inactive (the write coordination byte assumes the value "0"). In such an event, the controller might have to return the operating device to the appropriate state via the poll area!

The 4-byte area is either byte-oriented or word-oriented, depending on the address.

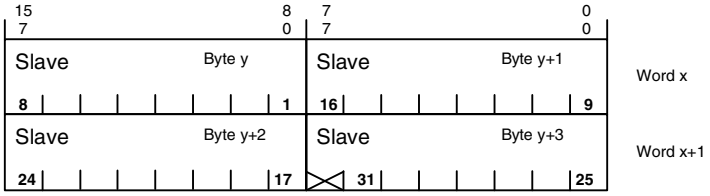



Figure 5-40 Structure of the 4-byte area for the network status

## 5.14.2 Programming

### 5.14.2.1 Protocol Parameters for the PLC Connection

The protocol parameters for the PLC connection are the same as the procotol parameters for the standard connection to the relevant controller.

### 5.14.2.2 Protocol Parameters for the DIN Measurement Bus Master

You can use the protocol parameters to influence the communication between the operating device and the controller. All parameters are set to the default values which ensure a reliable communication.

#### 5.14.2.2.1 Baud Rate

This parameter specifies the communication rate.

Table 5-240 Baud rate, DIN Measurement Bus master

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.14.2.2.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-241 Parity, DIN Measurement Bus master

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.14.2.2.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-242 Handshake, DIN Measurement Bus master

| Configurable Values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.14.2.2.4 Data Bits

This parameter specifies the number of data bits.

Table 5-243 Data bits, DIN Measurement Bus master

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

#### 5.14.2.2.5 Stop Bits

This parameter specifies the number of the stop bits.

Table 5-244 Stop bits, DIN Measurement Bus master

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.14.2.2.6 Slave Number

You can enter the slave number for the relevant slave terminal here. To load the same project on all slave terminals, you can set an invalid slave number here. You must then use the system variable ComSlaveNr. in the setup mask during runtime to set a correct slave number. Any invalid values are set to the value 255 (0xFF) when the operating device is started up.

Table 5-245 Slave number, DIN Measurement Bus master

| Configurable Values | Default Value |
|---|---|
| 1 to 31 | 0 |

### 5.14.3 Additional Error Messages

In addition to the "normal" error messages for this connection, the gateway operating device displays error messages associated with its use as a gateway. The subcode of these error messages always indicates the error numbers of the respective communication protocol.

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-246 Additional error messages, DIN Measurement Bus

| Code | Subcode | Error Tzpe | Possible Cause |
|---|---|---|---|
| 41 | | Error reading the cache from the controller | |
| 42 | | Error reading the gateway poll area | |
| 43 | | Error writing the gateway poll area | |
| 44 | | Wrong address syntax | One of the slave terminals contains a variable with an address syntax which is not compatible with the protocol of the gateway |
| 45 | | Error writing the network status to the controller | |
| 46 | | No gateway parameters | |

### 5.14.4 DIN Measurement Bus Slave

You can operate up to 30 slave terminals simultaneously on one DIN Measurement Bus. The slave terminals access the data of the bus master. All of the slave terminals function in the same way as when directly connected to a controller. You only have to adjust the interface parameters to the DIN Measurement Bus.

The bus master (process computer or gateway to PLC) and slave are connected via the DIN Measurement Bus, as specified in DIN 66348.

The services required for data exchange (user data of the DIN Measurement Bus protocol) are defined in the TesiBus specifications.

To reduce the workload on the bus, each slave terminal may have its own read-only data cache. The address location and length of the cache are negotiated during synchronization between the bus master and slave terminal. The bus master performs an equidistant transfer of the cache data by broadcasting them to all slave terminals and each slave terminal then saves this data locally.

If a slave terminal has a read request that is located within this cache area, no communication process takes place via the gateway to the PLC. Instead, the data is copied locally from the terminal cache.

Variables that are output just once and are contained within the cache area are output again once the next cache package is received. Since the gateway performs an equidistant transfer of cache data, this means that a rapid output with higher priority can be executed (independently of the general output cycle).

## 5.14.5 Programming

### 5.14.5.1 Protocol Parameters for the DIN Measurement Bus Slave

You can use the protocol parameters to influence the communication between the operating device and the controller. All parameters are set to the default values which ensure a reliable communication.

#### 5.14.5.1.1 Baud Rate

This parameter specifies the communication rate. You must specify the same baud rate for the gateway and the slave.

Table 5-247 Baud rate, DIN Measurement Bus slave

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.14.5.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-248 Parity, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.14.5.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-249 Handshake, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.14.5.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-250 Data bits, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

#### 5.14.5.1.5 Stop Bits

This parameter specifies the number of the stop bits.

Table 5-251 Stop bits, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | X |
| 2 | |

#### 5.14.5.1.6 Timeout for Order Reply

The slave starts a timer whenever data is required from the controller. This timer checks whether or not the slave terminal has been polled by the master and whether a reply from the bus master has been received during this period. If not using timeout monitoring, you must enter the value 0. The absolute timer value depends on the numbers of stations on the network. But it should be roughly between 2,000 and 5,000 milliseconds.

Table 5-252 Timeout for order reply, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65000 ms | 2000 ms |

#### 5.14.5.1.7 Timeout for Cache Update

Since the receiver cannot acknowledge the broadcast service, the slave terminal uses a timeout to monitor the exact time when broadcast data was received. This ensures that the local cache data is not from any "random time in the past". The value of this timeout depends on the cache update time of the bus master (see gateway parameters).

Table 5-253 Timeout for cache update, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65000 ms | 10000 ms |

#### 5.14.5.1.8 Slave Number

This parameter specifies the slave number for the relevant slave terminal. To be able to load the same mask definition into all slave terminals, you can enter an invalid slave number here. You must then use the system variable ComSlaveNr. in the setup mask during runtime to set a correct slave number. Any invalid values will be set to the value 255 (OxFF) at terminal startup.

Table 5-254 Slave number, DIN Measurement Bus slave

| Configurable Values | Default Value |
|---|---|
| 1 to 31ms | 0 |

## 5.14.6 Physical Interfacing

Plug-in connections on the operating device for connection to the DIN Measurement Bus master or Gateway.

### 5.14.6.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-255 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

### 5.14.6.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-256 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

#### 5.14.6.3 Cable X3 SER1 RS485 - Master/Slave

The following cabling diagram applies to operating devices with an universal interface **only**.

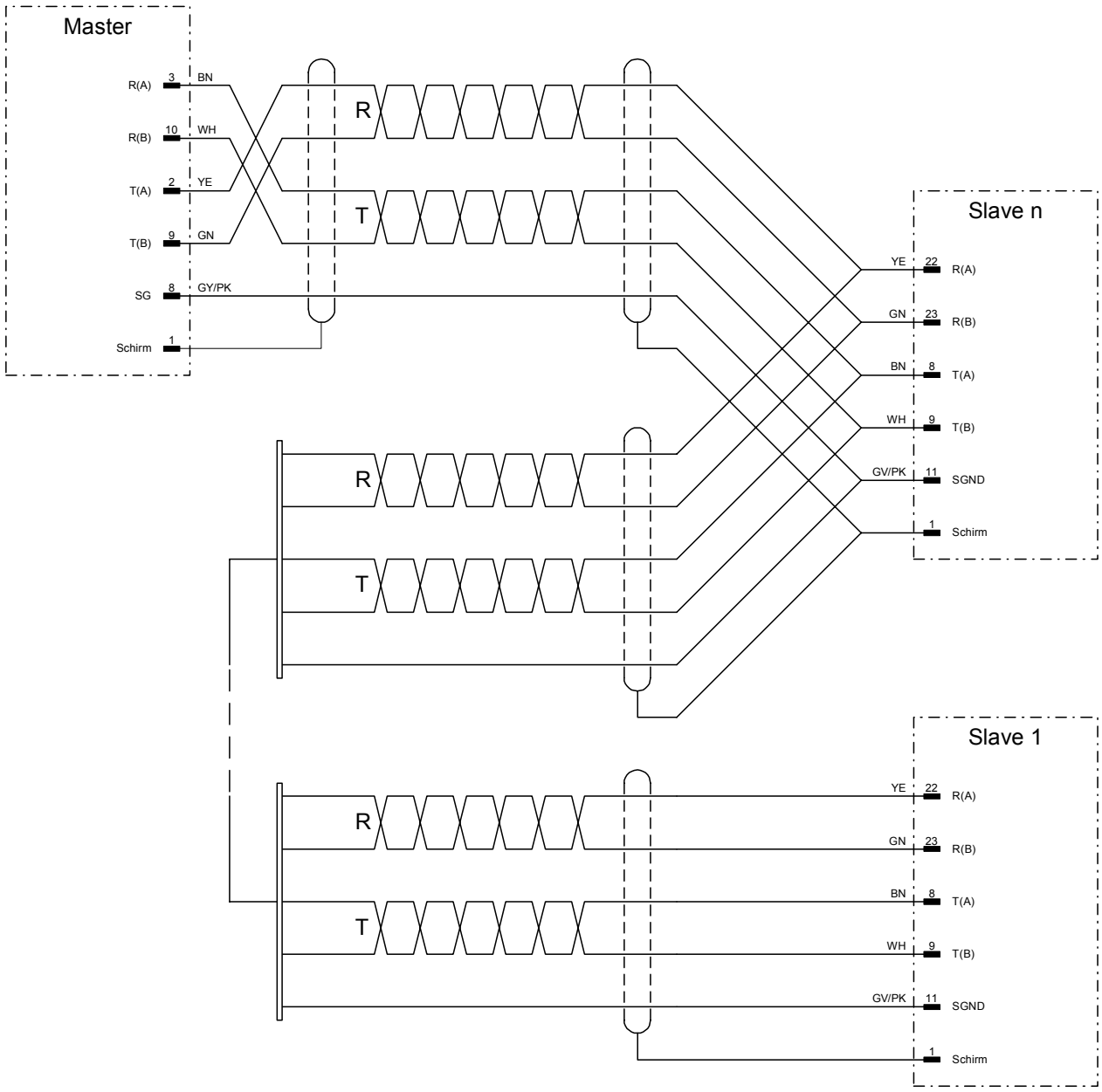



Figure 5-41 Cable X3 SER1 RS485 - master/slave

#### 5.14.6.4 Cable X2 RS485 - Master/Slave

The following cabling diagram does **not** apply to operating devices with an universal interface.

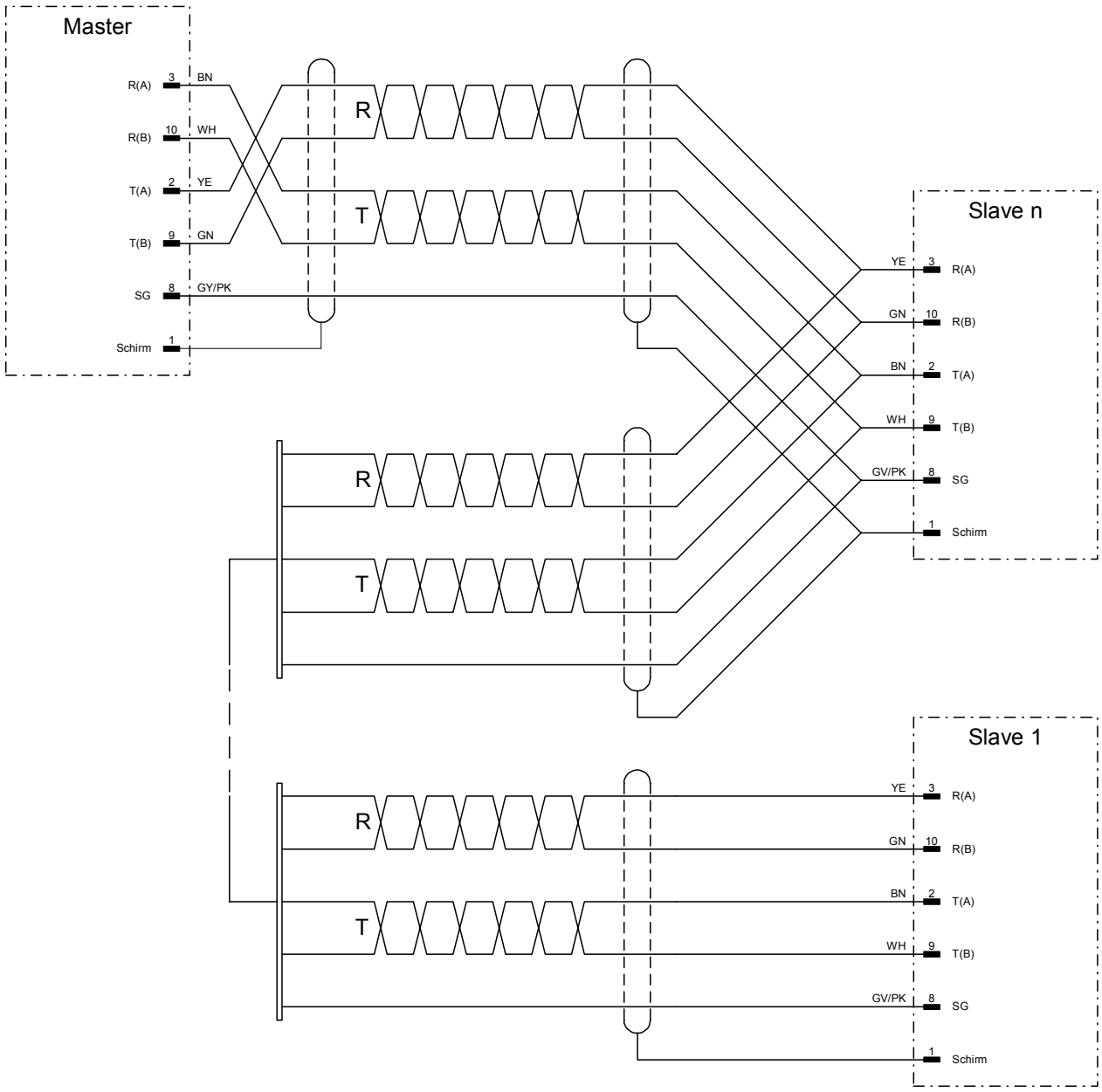



Figure 5-42 Cable X2 RS485 - master/slave

### 5.14.7 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-257 Error messages, DIN Measurement Bus

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 30 | | Slave is unable to send transmission data to master | |
| 31 | | Slave is unable to send transmission data to master (timeout) | |
| 32 | | Slave was unable to transmit its order within the timeout | |
| 33 | | Waiting time for receiving the order reply elapsed | |
| 34 | | Slave unable to receive the cache broadcast data within the timeout | |

## 5.15 Fanuc SNP

The GE Fanuc SNP protocol offers random read and write access to all data of the controller.

All byte-oriented data types can also be accessed in bit-mode.

Connect the operating device to the programming and communications port of the PLC's CPU. An additional communication module is not required.

You can also connect the operating device to port 2 of the CMM311 module.

Configuration of a bus topology is possible. In this case, use the LM90 to set the slave ID (CPU-ID) of the controller.

It is also possible to simultaneously connect an operating device and a hand-held programming device (HHP) or the Logicmaster in conjunction with a SNP multiplexer.

### 5.15.1 Data Types

Direct access is possible to the following data types.

The size of each data area is governed by the CPU of the controller.

Table 5-258 Fanuc SNP data types

| Type | Mnemonic | Access |
|---|---|---|
| Discrete Input | %I | Bit/Byte Access |
| Discrete Output | %Q | Bit/Byte Access |
| Temporary Coil | %T | Bit/Byte Access |
| Internal Coil | %M | Bit/Byte Access |
| System Status Reference | %SA, %SB, %SC, %S | Bit/Byte Access |
| Discrete Globals | %G | Bit/Byte Access |
| Analog Inputs | %AI | Word/Double Word Access |
| Analog Outputs | %AQ | Word/Double Word Access |
| Registers | %R | Word/Double Word Access |

## 5.15.2 Programming

### 5.15.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.15.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-259 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.15.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-260 Parity

| Configurable values | Default Value |
|---|---|
| None | |
| Even | |
| Odd | X |

#### 5.15.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-261 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.15.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-262 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.15.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-263 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.15.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-264 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 1000 ms |

#### 5.15.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-265 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 100 ms to 65535 ms | 10000 ms |

#### 5.15.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

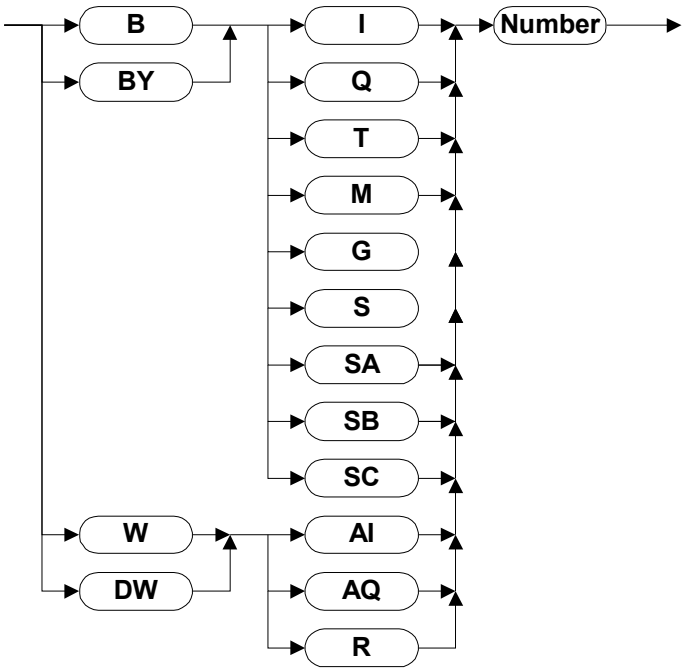



Figure 5-43 Syntax diagram

The operating device considers the Fanuc controller a slave and, thus, references it via aslave number..

Enter the slave number for every variable which is specified in the controller as a CPU ID. Valid CPU ID numbers range from value 001 to value 253. The slave number must in the range of 1 to 253.

Do not specify a slave number if you are implementing a pure point-to-point connection. In this case, specify the value 254 as CPU ID in the controller.

### 5.15.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.15.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-266 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.15.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-267 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

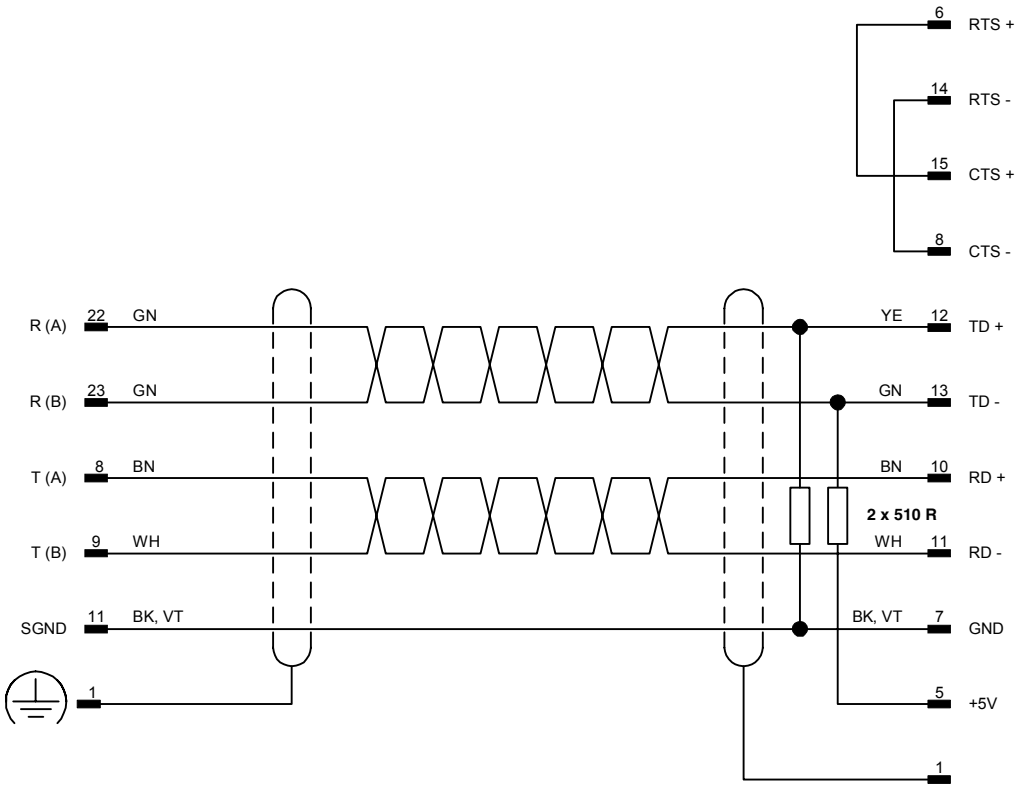
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.15.3.3 Cable X3 SER1 RS485 - Fanuc Series 90

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Fanuc
Series 90




D-SUB
male connector
25 pin

D-SUB
male connector
15 pin

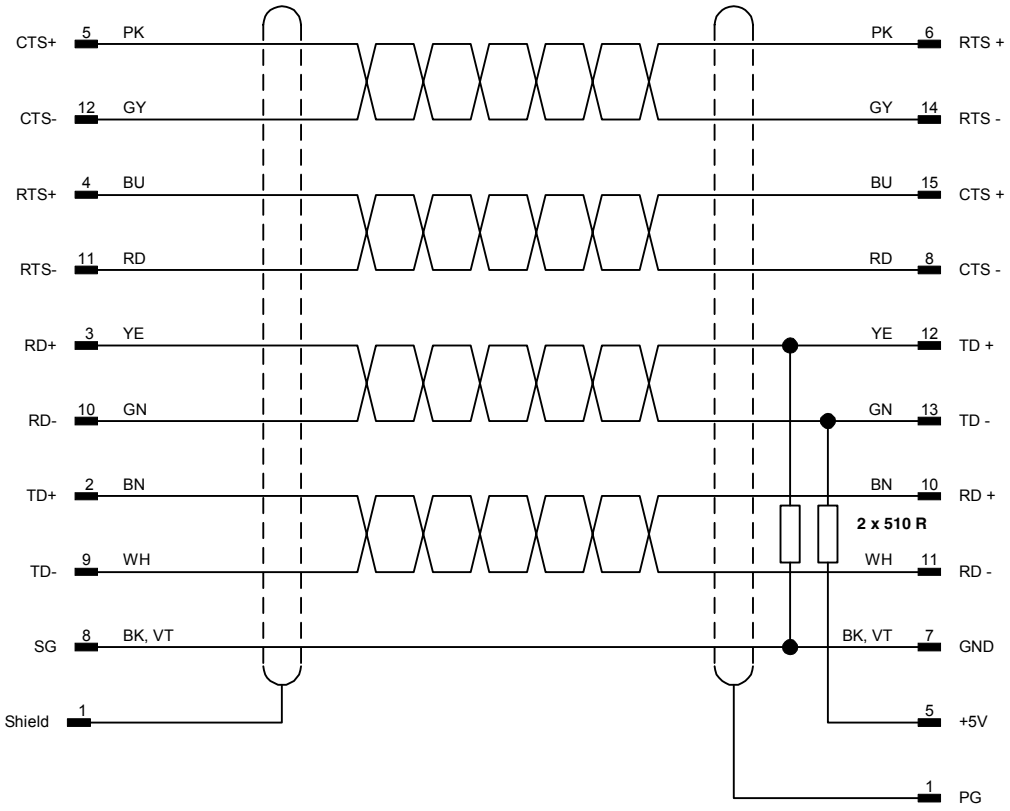
Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

#### 5.15.3.4 Cable X2 RS485 - Fanuc Series 90

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Fanuc
Series 90




D-SUB
male connector
15 pin

D-SUB
male connector
15 pin

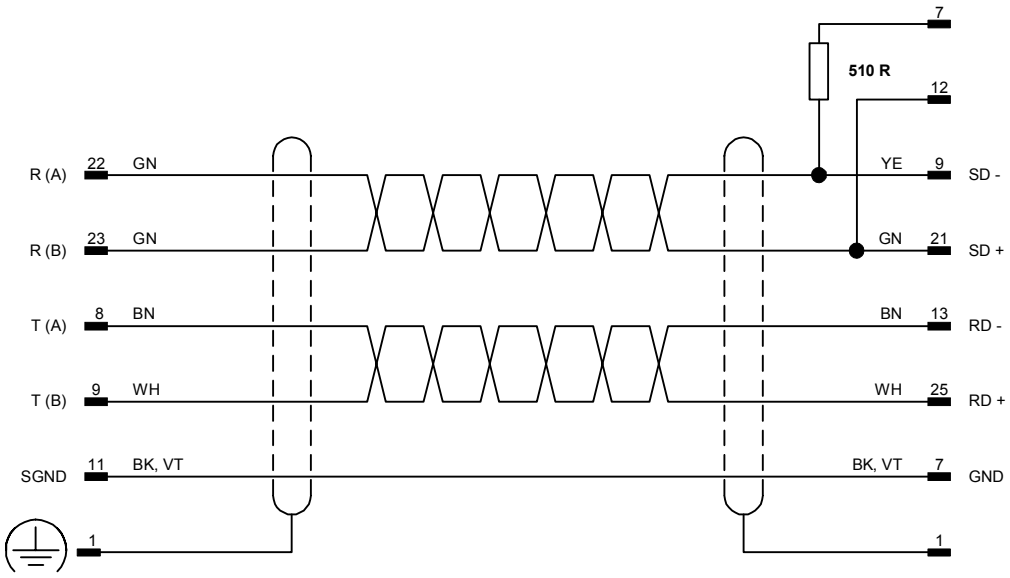
Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

### 5.15.3.5 Cable X3 SER1 RS485 - Fanuc CMM311

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Fanuc
CMM311




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

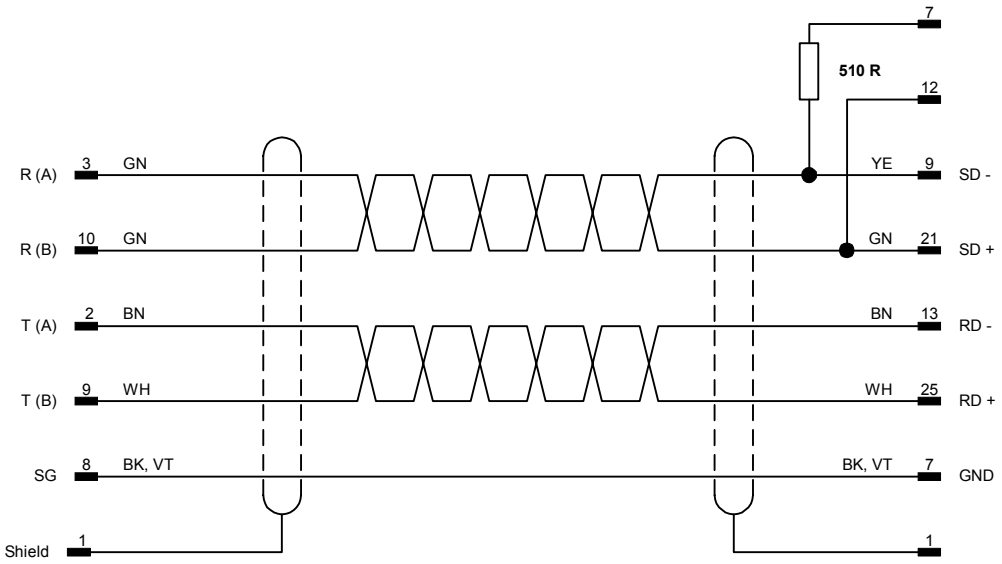
Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

#### 5.15.3.6 Cable X2 RS485 - Fanuc CMM311

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Fanuc
CMM311




D-SUB
male connector
15 pin

D-SUB
male connector
15 pin

Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

### 5.15.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-268 Fanuc SNP error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Controller not ready or wrong CPU ID set or specified. |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 4 | | Waiting time elapsed (Timeout) | Connection broken. |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 14 | | Invalid slave number | Maybe address of master specified (0x00) |
| 15 | | Protocol error | Selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 18 | | BCC or parity error from controller | |
| 19 | | Overrun or framing error fromcontroller | |
| 20 | | Sequence error from controller | |
| 21 | | Bad Message Length errorfrom controller | |
| 40 | | System variable orslave number related error | Undefined system variable orslave number 255 specified |
| Fanuc-specific error messages: | | | |
| 50 to 138 | | Major Error Status CodeThe error number consists ofthe constant 50 and the errorstatus code | |
| 178 to 255 | | Minor Error Status Code of the SNP partner module | |

## 5.16 Idec Micro3

The Idec Micro3 protocol provides random bit, byte and word access to all data of the controller in read and write mode.

### 5.16.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the CPU of the controller.

Table 5-269 Idec Micro3 data types

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | I | Bit Access |
| Input Byte | IB | Byte Access |
| Input Word | IW | Word Access |
| Output Bit | Q | Bit Access |
| Output Byte | QB | Byte Access |
| Output Word | QW | Word Access |
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Register Bit | R | Bit Access |
| Register Byte | RB | Byte Access |
| Register Word | RW | Word Access |
| Data Register | DW | Word Access |
| Timer Preset Value | TP | Word access, read onlyUse a data register to set the timer. |
| Timer Current Value | TC | Word Access, Read Only |
| Counter Preset Value | CP | Word access, read onlyUse a data register to set the counter. |
| Counter Current Value | CC | Word Access, Read Only |
| High-Speed Counter Preset Value | HP | Double-Word Access, Read OnlyDo not use in a table |
| High-Speed Counter Current Value | HC | Double-Word Access, Read OnlyDo not use in a table |

## 5.16.2 Programming

### 5.16.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.16.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-270 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.16.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-271 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.16.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-272 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.16.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-273 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

#### 5.16.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-274 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.16.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-275 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 10 ms to 2550 ms | 500 ms |

#### 5.16.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-276 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 10 ms to 65535 ms | 10000 ms |

#### 5.16.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

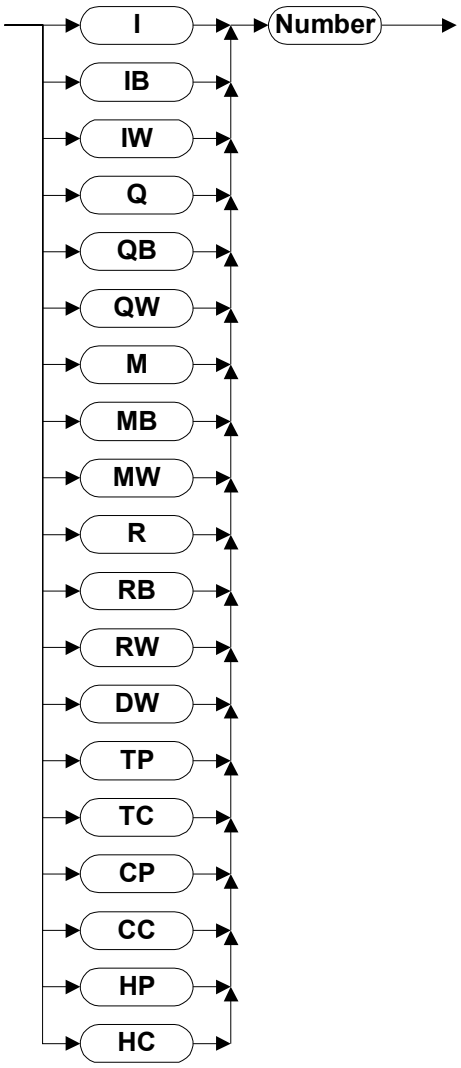



Figure 5-44 Syntax diagram

## 5.16.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.16.3.1 Pin assignment for operating devices with a universal interface

Table 5-277 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.16.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-278 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

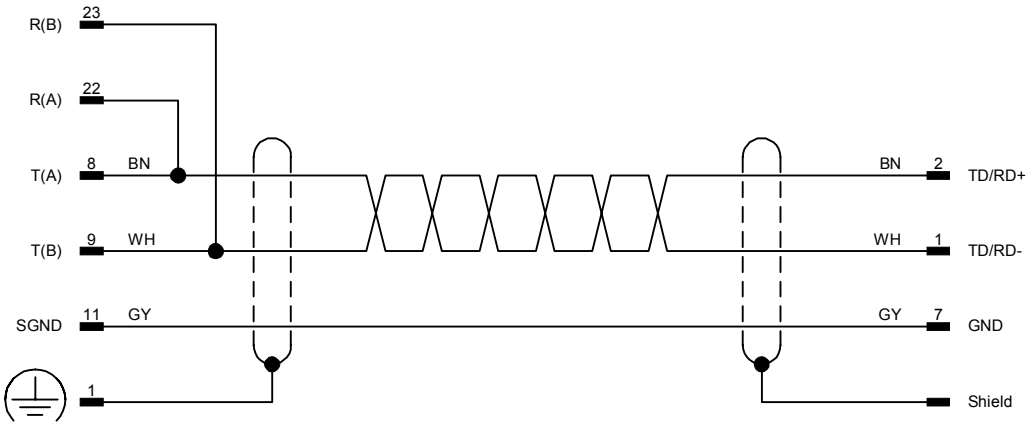
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.16.3.3 Cable X3 SER1 RS485 - Idec Micro3

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Idec Micro3




D-SUB
male connector
25 pin

DIN 41524
angled
male connector
8 pin

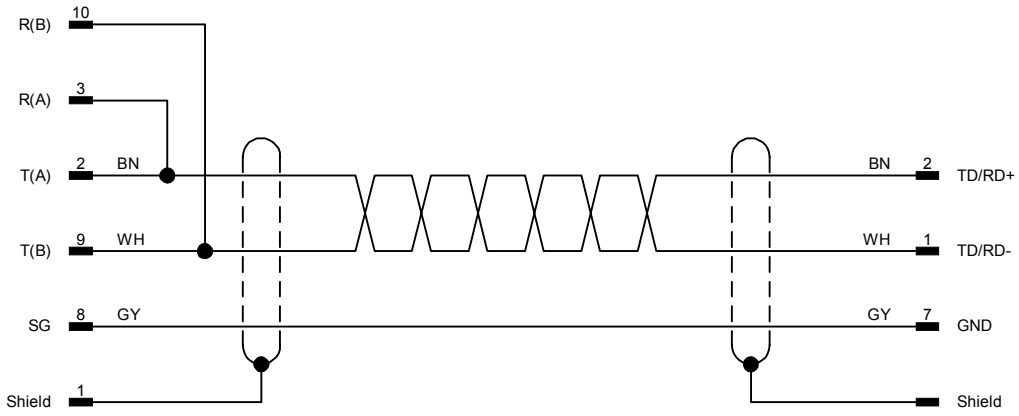
Both ends of the shield are connected to the metallic housing.

#### 5.16.3.4 Cable X2 RS485 - Idec Micro3

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Idec Micro3




D-SUB
male connector
9 pin

DIN 41524
angled
male connector
8 pin

Both ends of the shield are connected to the metallic housing.

### 5.16.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-279 Idec Micro3 error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 1 | Slave not ready | |
| | 2 | Packets out of sequence | |
| | 3 | Error in protocol frame | |
| | 4 | Waiting time elapsed (Timeout) | Connection broken. |
| | 6 | Wrong parity | |
| | 7 | Send process aborted | |
| | 8 | Receive process aborted | |
| | 9 | Cyclic buffer overrun | Cyclic buffer too small |
| | 10 | No cyclic data defined | |
| | 12 | Cyclic data already defined | |
| | 15 | Protocol error | The selected protocol is not supported. |
| | 16 | Receive buffer overrun | |
| | 40 | System variable error | Undefined system variable |
| | 50 | Waiting time for response elapsed | No response from controller |
| 2 | 58 | Incorrect number of data received | Check if the mask, in which the error occurred, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| 3 | | Error from the controller | |
| | 6 | Data area error | Write-access to flag >= 290 not possible. Address does not exist in controller |
| | 7 | Error writing to timer or counter | Writing to timer and counter not permitted |
| | 10 | Wrong data coding | |

Table 5-279 Idec Micro3 error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 17 | | The subcode contains the error which a controller sends in the response telegram. | |
| | 00 | BCC error | |
| | 01 | Error in protocol frame | |
| | 02 | Wrong parity | |
| | 03 | Illegal command | Writing to high-speed counter not permitted |
| | 04 | Error in procedure | |

## 5.17 INTERBUS MMICOM Interface 02, 10, 15, 23

The **INTERBUS MMICOM Interface 02, 10, 15, 23** protocol allows a communication between a TesiMod operating device of the standard model and an INTERBUS Master. For this purpose, a BK06 bus node which uses the MMI-COM protocol is inserted. The bus node is connected to the operating device by a RS232c interface and to the INTERBUS structure by an optical fiber cable.

The serial register extension SRE is used for the communication. This makes it possible to exchange 8 bytes of user data through the INTERBUS.

The BK06 bus node identifies itself to the INTERBUS with ID code 47.

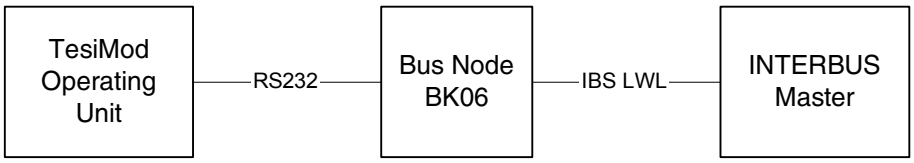



Figure 5-45 Connection of operating device, bus node and INTERBUS

### 5.17.1 MMICOM Structure

The MMI structure comprises 5 or 6 words depending on the configuration of the bus node (8 I/O or 16 I/O).

Table 5-280 MMI structure for BK06 with 8 inputs and 8 outputs:

| Byte | Content |
|---|---|
| 1 | Control Byte |
| 2 | PD index |
| 3 | Variable high |
| 4 | Variable low |
| 5 | MMI |
| 6 | MMI |
| 7 | MMI |
| 8 | MMI |
| 9 | Copy of control byte |
| 10 | Inputs _.0 to _.7 or outputs _.0 to _.7 |

Table 5-281 MMI structure for BK06 with 16 inputs and 8 outputs

| Byte | Content |
|---|---|
| 1 | Control Byte |
| 2 | PD index |
| 3 | Variable high |
| 4 | Variable low |
| 5 | MMI |
| 6 | MMI |
| 7 | MMI |
| 8 | MMI |
| 9 | Copy of control byte |
| 10 | Inputs _.0 to _.7 or outputs _.0 to _.7 |
| 11 | Optional inputs _.8 to _.15 |
| 12 | Reserved |

### 5.17.2 Data Types

The data types specify how many bytes are assigned to a single variable.

Table 5-282 Data types for INTERBUS BK06

| Data type | Access to | Length of Single Variable | Comment |
|---|---|---|---|
| BY | Byte (and Bit also) | 1 Byte | Next byte is located 1 address higher |
| W | Word | 2 Bytes | Next word is located 1 address higher |
| W-2 | Word | 2 Bytes | Next word is located 2 addresses higher |
| DW | Double Word | 4 Bytes | Next double word is located 1 address higher |
| DW-2 | Double Word | 4 Bytes | Next double word is located 2 addresses higher |
| DW-4 | Double Word | 4 Bytes | Next double word is located 4 addresses higher |

The following convention applies to data with a data length of more than 4 bytes (for example, alphanumeric texts, tables, polling area, status messages):
Depending on the access type, the data is processed with the corresponding one-, two-, or four-byte access. If there is other data to be processed, it is assumed that this data is located under the next higher variable number in each case.

**Example:**

A 10-character text string starting at variable 100 (access W- word) consists of the variables 100 to 104.

## 5.17.3 Programming

To select the correct interface variant in the programming software, take note of the ID on the label attached to the operating device.

The two digits after the slash indicate the interface variant (printed in bold in the example displayed below).

**For example:** TP32ET/**16**9032

### 5.17.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.17.3.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-283 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | |
| 38400 | X |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.17.3.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-284 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.17.3.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-285 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.17.3.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-286 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.17.3.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-287 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.17.3.1.6 MMICOM Handshake Timeout

This parameter specifies how long the operating device waits for an acknowledgement from the controller.

Table 5-288 MMICOM handshake timeout

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 1000 ms |

#### 5.17.3.1.7 Maximum Waiting Time for Response

This parameter specifies how long the operating device waits for a response from the PLC.

Table 5-289 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 1000 ms |

#### 5.17.3.1.8 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-290 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 0 s to 20 s | 2 s |

#### 5.17.3.1.9 Floating Point Number in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

Table 5-291 Floating point number in the Siemens format

| Configurable Values | Default Value |
|---|---|
| IEEE Format | |
| Siemens Format | X |

#### 5.17.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

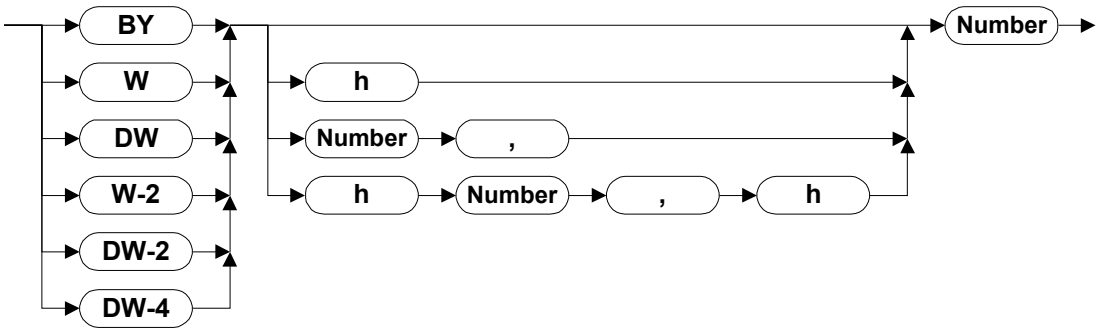



Figure 5-46 Syntax diagram

## 5.17.4 Physical Interfacing

Use the RS232 interface to connect an operating device to the bus node BK06.

### 5.17.4.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-292 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.17.4.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-293 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.17.4.3 Pin Assignment for Bus Node

Table 5-294 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | nc | Not Connected |

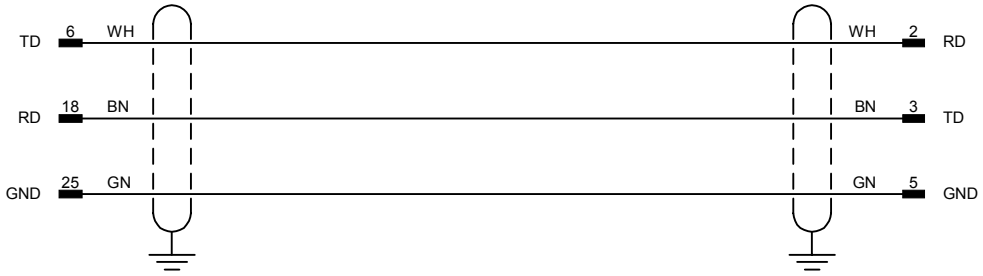
Table 5-294 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

#### 5.17.4.4 Cable X3 SER1 RS232 - Bus Node BK06

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device




Bus node

D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

### 5.17.5 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-295 Error messages for INTERBUS MMICOM Interface 02, 10, 15, 23

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 2 | | The controller sent data to the operating device which the operating device did not request. | |
| 4 | xx | Timeout error.<br>The subcode specifies the requested variable number. | |
| 40 | | Illegal system variable. | The project contains an illegal system variable. |
| 50 | | Malfunction bit not set by controller. | |
| 51 | | Online bit of controller is not set. | Bus is not running. PLC program is missing or controller is in STOP mode. |
| 52 | | Standard bit of controller is not set. | Bus is not running. PLC program is missing or controller is in STOP mode. |
| 53 | xx | Wrong PD index received.<br>The subcode specifies the PD index received. | |
| 54 | | Handshake error (receive timeout). | PLC program missing or controller is in STOP mode. |
| 55 | | Handshake error (send timeout). | PLC program missing or controller is in STOP mode. |
| 56 | | Variable has wrong base size. | |
| 57 | | Handshake error. | Handshake bits were not set correctly by controller. |
| 58 | | Access error. | No SPI communication possible. |
| 59 | xx | Wrong variable number received.<br>The subcode specifies the variable number received. | |
| 60 | xx | Wrong PD index received.<br>The subcode specifies the PD index received. | |
| 61 | | INTERBUS reset interrupt. | An INTERBUS reset interrupt was triggered; the outputs are deactivated. |
| 62 | | Wrong micro controller program version. | |

Table 5-295 Error messages for INTERBUS MMICOM Interface 02, 10, 15, 23

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 70 | | Transmission error | |
| | 0x0B | NAK during disconnect | |
| | 0x0C | NAK during disconnect | |
| | 0x15 | QVZ (acknowledgment delay) on connection setup | |
| | 0x17 | NAK during disconnect | |
| | 0x19 | Both partners have high priority | |
| 71 | | Receive error | |
| | 0x03 | Hardware error | |
| | 0x0F | Receive box blocked | |
| | 0x13 | No further repetition | |
| | 0x15 | Block delay | |
| | 0x17 | Wrong BCC | |

# 5.18 INTERBUS Siemens S7 Functions, Interface 02, 10, 23

The INTERBUS Siemens S7 Functions protocol allows a communication between a TesiMod operating device and an OPC INTERBUS interface. The operating device is connected to the INTERBUS using an optical fiber cable.

The serial register extension SRE is used for communication. This makes it possible to exchange 8 bytes of user data through the INTERBUS.

## 5.18.1 PCP Structure

The PCP structure comprises 10 bytes.

Table 5-296 PCP structure with 8 inputs and 8 outputs

| Byte | Content |
|---|---|
| 1 | PCP code |
| 2 | PCP |
| 3 | PCP |
| 4 | PCP |
| 5 | PCP |
| 6 | PCP |
| 7 | PCP |
| 8 | PCP |
| 9 | Optional inputs _.8 to _.15 |
| 10 | Inputs _.0 to _.7 or outputs _.0 to _.7 |

### 5.18.1.1 ID Code

The operating device uses ID code 241 to identify itself to the INTERBUS as a 4-word PCP participant.

### 5.18.1.2 Process Data

The operating device identifies itself to the INTERBUS with 16 bit process data located in byte 9 and 10.

## 5.18.2 Data Types

Use the following data types for a direct access. Values marked by xxx depend on the configuration of the controller.

Table 5-297 Data types for INTERBUS Siemens S7 Functions

| Data Type | Mnemonic | From | Up to | | From | Up to | Access Authorization |
|---|---|---|---|---|---|---|---|
| Counter | Z | 0 | xxx | | | | View only |
| Timer | T | 0 | xxx | | | | View only |
| Input | E | 0.0 | xxx.7 | | | | |
| | EB | 0 | xxx | | | | |
| | EW | 0 | xxx | | | | |
| | ED | 0 | xxx | | | | |
| Output | A | 0.0 | xxx.7 | | | | |
| | AB | 0 | xxx | | | | |
| | AW | 0 | xxx | | | | |
| | AD | 0 | xxx | | | | |
| Flag | M | 0.0 | xxx.7 | | | | |
| | MB | 0 | xxx | | | | |
| | MW | 0 | xxx | | | | |
| | MD | 0 | xxx | | | | |
| Peripheral Input | PEB | 0 | xxx | | | | |
| | PEW | 0 | xxx | | | | |
| | PED | 0 | xxx | | | | |
| Peripheral Output | PAB | 0 | xxx | | | | |
| | PAW | 0 | xxx | | | | |
| | PAD | 0 | xxx | | | | |
| Data Blocks | DB | 1 | 255 | DBX | 0.0 | 8191.7 | |
| | | | | DBB | 0 | 8191 | |
| | | | | DBW | 0 | 8190 | |
| | | | | DBD | 0 | 8188 | |

## 5.18.3 Programming

### 5.18.3.1 Protocol Parameters

You can use the protocol parameters to influence the communication between the operating device and the bus node. All parameters are set to the default values which ensure a reliable communication.

#### 5.18.3.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-298 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | |
| 38400 | X |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.18.3.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-299 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.18.3.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-300 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.18.3.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-301 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.18.3.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-302 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.18.3.1.6 Maximum Waiting Time for Response

This parameter specifies how long the operating device waits for a response from the PLC.

Table 5-303 MMICOM handshake timeout

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 1000 ms |

The timeout period for response must clearly exceed the cycle time of the controller. The bus node waits for one quarter of the defined timeout period before starting a repeat transmission. This repeat transmission is executed no more than twice, after which the operating device returns a communication error. If the timeout period defined is 1000 ms, the first repeat transmission is sent after 250 ms and the second repeat transmission after a total of 500 ms. The communication error is issued if the controller does not reply within approximately 750 ms in total.

#### 5.18.3.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-304 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 0 s to 20 s | 2 s |

#### 5.18.3.1.8 Floating Point Number in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

Table 5-305 Floating point number in the Siemens format

| Configurable Values | Default Value |
|---|---|
| IEEE Format | |
| Siemens Format | X |

#### 5.18.3.1.9 Data Consistency via Hardware

Select the "Data Consistency via Hardware" check box if a data consistency for a 64-bit width has been configured and ensured for the master controller board of the INTERBUS. If this check box is not selected, the terminal INTERBUS driver delays the terminal out bus data by 15 ms. This delay impairs communication performance. For further information on data consistency, see the documentation on the master module.

#### 5.18.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

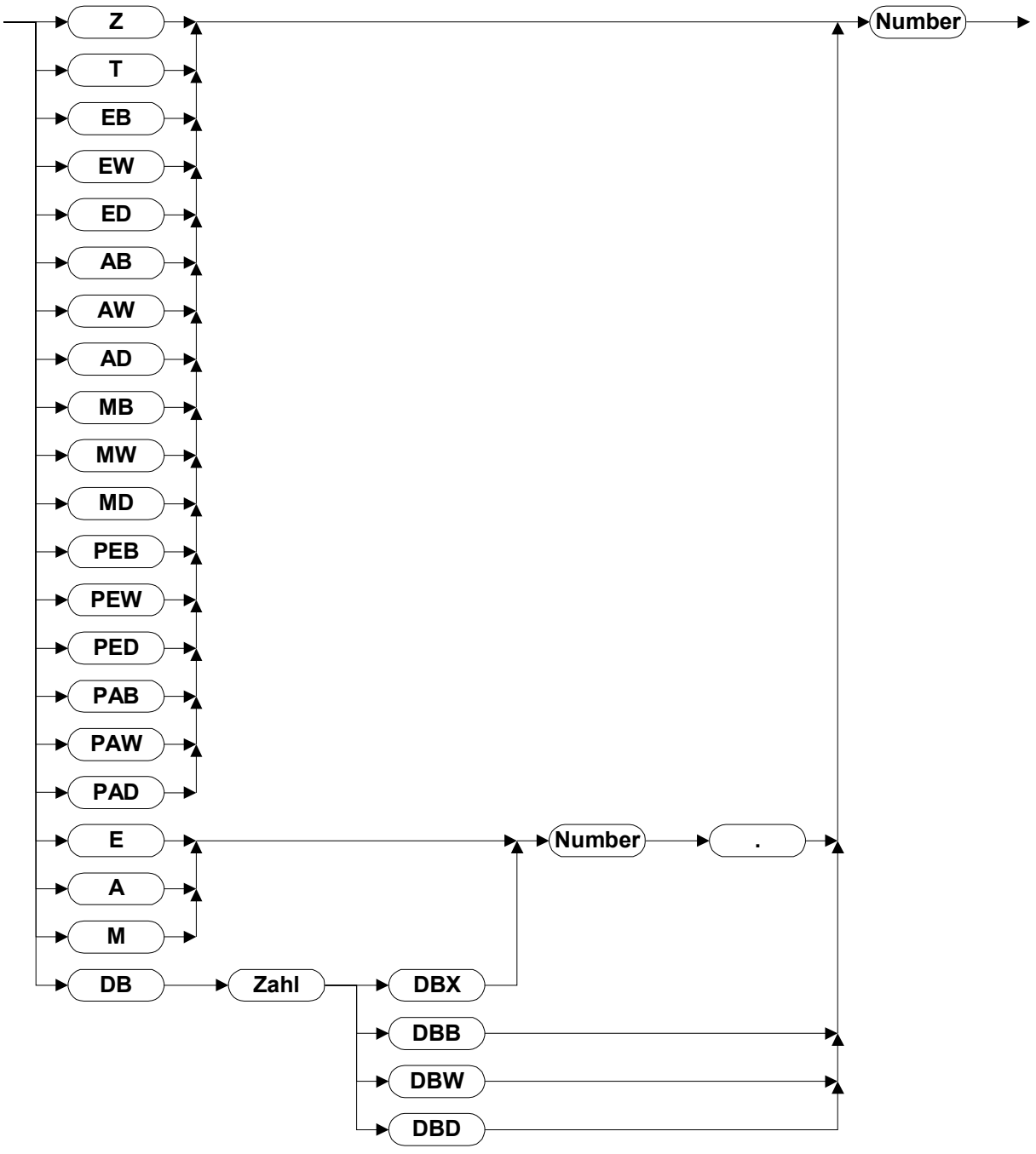



Figure 5-47 Syntax diagram

## 5.18.4 Physical Interfacing

Use the RS232 interface to connect an operating device to the bus node BK06.

### 5.18.4.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-306 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.18.4.2 Pin assignment for operating devices without a universal interface

Table 5-307 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.18.4.3 Pin Assignment for Bus Node

Table 5-308 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | nc | Not Connected |
| 5 | GND | Ground |

Table 5-308 Pin assignment RS232

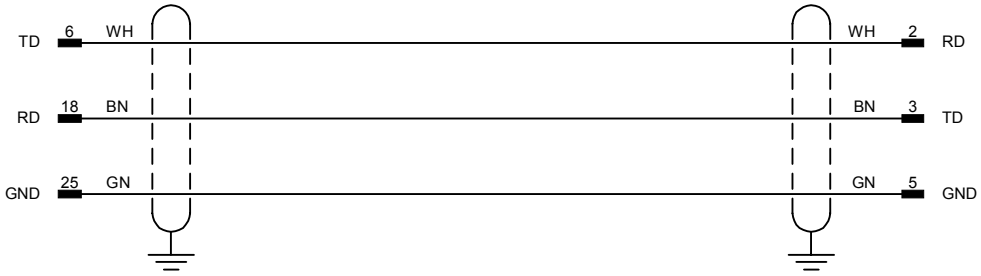
| Pin | Designation | Function |
|---|---|---|
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

#### 5.18.4.4 Cable X3 SER1 RS232 - Bus Node BK06

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Bus node




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

### 5.18.5 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-309 Error messages for INTERBUS Siemens S7 Functions

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 4 | | Timeout error | |
| | XXXX | Address of the data requested last | |
| 50 | | Error when initializing bus node | |
| | 100 | BUS_AKTIV (bus_active), but no response from S7 yet | |
| | 101 | BUS_NICHT_AKTIV (bus_not_active) | |
| 54 | | No response to information report within configured time | |
| | 100 | BUS_AKTIV (bus_active), but no response from S7 yet | |
| | 101 | BUS_NICHT_AKTIV (bus_not_active) | |
| | 102 | DATA_ABORT_S7 | |
| 59 | | Wrong packet number received | |
| | XXXX | The received packet number | |
| 62 | | Wrong micro controller program version | |
| | XXXX | Program version of the Micro controller | |
| 64 | | Wrong number of data received | |
| | XXXX | Number of data received | |
| 67 | | Illegal packet length | |
| | XXXX | Requested packet length | |
| 70 | | Error sending a request | |
| | 0x0B | NAK during disconnect | |
| | 0x0C | NAK during disconnect | |
| | 0x15 | QVZ (acknowledgment delay) on connection setup | |
| | 0x17 | NAK during disconnect | |
| | 0x19 | Both partners have high priority | |
| 71 | | Error receiving a request | |
| | 0x03 | Hardware error | |
| | 0x0F | Receive box blocked | |

Table 5-309 Error messages for INTERBUS Siemens S7 Functions

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| | 0x13 | No further repetition | |
| | 0x15 | Block delay | |
| | 0x17 | Wrong BCC | |
| 72 | | Initialization response has wrong length | |
| | XXXX | The received length | |
| Logical error from decoding function FC78 | | | |
| 150 | | Specified source data block cannot be opened | |
| | XXXX | DB number | |
| 151 | | Specified target data block cannot be opened | |
| | XXXX | DB number | |
| 152 | | Unknown area for bit data | |
| | XXXX | Start byte | |
| 153 | | Unknown area for receiving byte data | |
| | XXXX | Start byte | |
| 154 | | Data block to be written to with bit data does not exist | |
| | XXXX | DB number | |
| 155 | | Data block to be written to with byte data does not exist | |
| | XXXX | DB number | |
| 156 | | Data block from which transmission data are to be read does not exist | |
| | XXXX | DB number | |
| 157 | | Unknown area for transmit byte data | |
| | XXXX | Area number | |
| 158 | | Wrong number of data block for range data | |
| | XXXX | DB number | |
| 159 | | Wrong length for range data block | |
| | XXXX | Start byte | |

Table 5-309 Error messages for INTERBUS Siemens S7 Functions

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 160 | | Range exceeded for periphery bit data | The size of the addressed range for received data exceeds the available range. |
| | XXXX | Start address of range to be written to | |
| 161 | | Range exceeded for input bit data | |
| | XXXX | Start address of range to be written to | |
| 162 | | Range exceeded for output bit data | |
| | XXXX | Start address of range to be written to | |
| 163 | | Range exceeded for flag bit data | |
| | XXXX | Start address of range to be written to | |
| 164 | | Range exceeded for data block bit data | |
| | XXXX | Start address of range to be written to | |
| 170 | | Range exceeded for peripheral byte data | |
| | XXXX | Start address of range to be written to | |
| 171 | | Range exceeded for input byte data | |
| | XXXX | Start address of range to be written to | |
| 172 | | Range exceeded for output byte data | |
| | XXXX | Start address of range to be written to | |
| 173 | | Range exceeded for flag byte data | |
| | XXXX | Start address of range to be written to | |
| 174 | | Range exceeded for data block byte data | |
| | XXXX | Start address of range to be written to | |
| 175 | | Range exceeded for counter word data | |
| | XXXX | Start address of range to be written to | |
| 176 | | Range exceeded for timer word data | |
| | XXXX | Start address of range to be written to | |

Table 5-309 Error messages for INTERBUS Siemens S7 Functions

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 180 | | Range exceeded for periphery byte data | The size of the addressed range for transmission data exceeds the available range. |
| | XXXX | Start address of requested range | |
| 181 | | Range exceeded for input byte data | |
| | XXXX | Start address of requested range | |
| 182 | | Range exceeded for output byte data | |
| | XXXX | Start address of requested range | |
| 183 | | Range exceeded for flag byte data | |
| | XXXX | Start address of requested range | |
| 184 | | Range exceeded for data block byte data | |
| | XXXX | Start address of requested range | |
| 185 | | Range exceeded for counter word data | |
| | XXXX | Start address of requested range | |
| 186 | | Range exceeded for timer word data | |
| | XXXX | Start address of requested range | |

## 5.18.6 Applications

### 5.18.6.1 Siemens S7-400

#### 5.18.6.1.1 OB1

First of all, OB1 calls the FC12 once with Mode 10 (Handshake enable).

In OB1, the function block FB171 is called once for all operating devices within the INTERBUS segment. In FB171, the function block FB71 is then called once for each operating device.

FB71 uses the function codes

– FC19 (displays FC12 in Mode 20 and only information reports are transferred)
– FC78 (for decoding the information reports received)
– FC18 (for returning the requested data via Compact PCP)

At the end of OB1, FC14 is called once with Mode 10 (Handshake disable).

Communication takes place as follows.

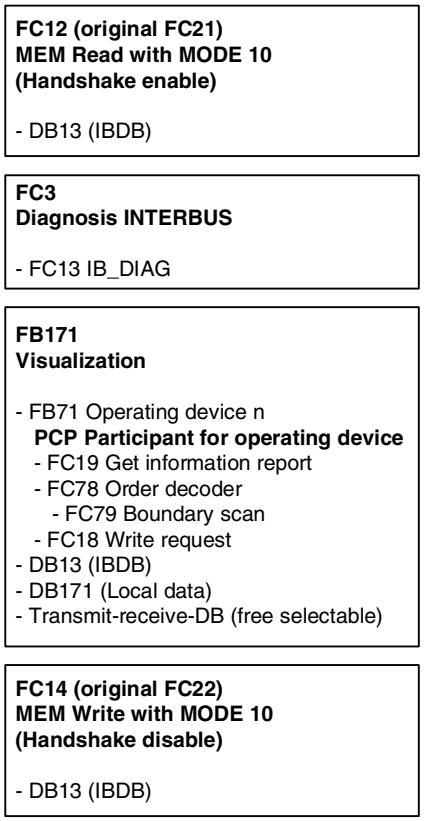



Figure 5-48 Structure of the OB1 when using a bus node

If you are installing several operating devices within the INTERBUS segment, you must call FB71 once for each of these operating devices.

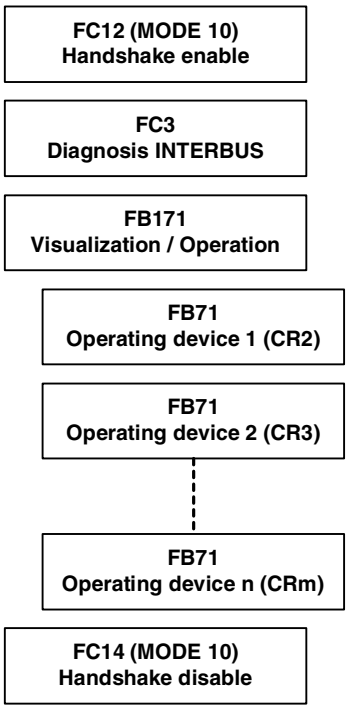



Figure 5-49 Structure of the OB1 for multiple operating devices with bus node

Each PCP participant has its own communication reference (CR).

There is a risk that information report telegrams may be lost if the handshake operation is executed twice during an OB1 cycle.

#### 5.18.6.1.2 OB100 and OB101

The functions FC8 and FC11 are called up in OB100 and OB101.

The function blocks must be called in the following order:

1. FC8
2. FC11

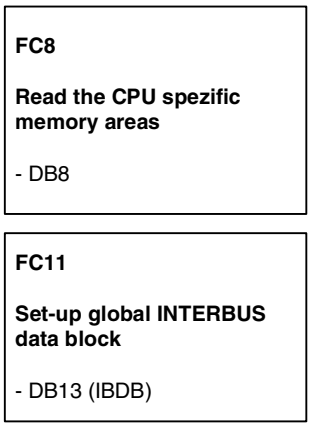



Figure 5-50 Structure of OB100 and OB101

#### 5.18.6.1.3 Function Block FB71

In function block FB171, enter a call instruction for function block FB71 for every operating device. Function block FB71 manages the requests from the operating device received through PCP.

Function FC78 decodes the requests from the operating device.

Function FC79 carries out the range check on the requests.

The areas for the transmission data and received data are located in the variable list of function block FB71. Both areas have a fixed length.

– Area for received area = 68 bytes
– Area for transmission data = 58 bytes

Always specify the instance data block of the calling function block as data block for the received data and the transmission data.

**Call instruction:**

```
CALL  #Pult_1
```

Table 5-310 FB71 parameters

| Parameter | Value | Description |
|---|---|---|
| InstDB | #InstDB | Number of instance data block for FB171 |
| IBS_ParamDB | 13 | Number of INTERBUS parameter data block |
| CommRef | 2 | Communication reference of operating device |
| Source_DB | #InstDB | Instance data block for information report |
| Source_Offset | 80 | Offset in instance data block for information report |
| Dest_DB | #InstDB | Instance data block for transmission data |
| Dest_Offset | 148 | Offset in instance data block for transmission data |
| InitZyk | MB1 | Request for new connection setup |
| DatenCpuDb | 8 | Number of data block for range data |
| DatenCpuDb-Offset | 248 | Offset in data block for range data |
| IBSRunStopBit | M13.0 | Bus malfunction when changing from 1 to 0. InitZyk is set when changing from 0 to 1. |
| TimerSim | M0.5 | Flag bit for timer simulator must correspond to hardware configuration of the Simatic Manager (cycle time/clock flag) |
| Maskenanwahl | MW4444 | Mask number for mask switching |

Table 5-311 FB71 variable declaration

| Address | Declaration | Name | Type | Starting Value | Comment |
|---|---|---|---|---|---|
| 0.0 | in | InstDB | INT | 0 | |
| 2.0 | in | IBS_ParamDB | INT | 0 | |
| 4.0 | in | CommRef | INT | 0 | |
| 0.6 | in | SourceDB | INT | 0 | |

Table 5-311 FB71 variable declaration

| Address | Declaration | Name | Type | Starting Value | Comment |
|---|---|---|---|---|---|
| 8.0 | in | Source_Offset | INT | 0 | |
| 10.0 | in | Dest_DB | INT | 0 | |
| 12.0 | in | Dest_Offset | INT | 0 | |
| 14.0 | in | InitZyk | BYTE | B#16#0 | |
| 16.0 | in | DatenCpuDb | INT | 0 | |
| 18.0 | in | DatenCpuDbOffset | INT | 0 | |
| 20.0 | in | IBSRunStopBit | BOOL | FALSE | |
| 20.1 | in | TimerSim | BOOL | FALSE | |
| | out | | | | |
| 22.0 | in_out | Maskenanwahl | INT | 0 | Mask number for mask selection |
| 24.0 | stat | Daten1 | ARRAY[1..48] | B#16#0 | |
| *1.0 | stat | | BYTE | | |
| 72.0 | stat | toggle_vari | STRUCT | | |
| +0.0 | stat | RetInit | BOOL | FALSE | |
| +0.1 | stat | BusyInit | BOOL | FALSE | |
| +0.2 | stat | RetGetInf | BOOL | FALSE | |
| +0.3 | stat | RetBusyInf | BOOL | FALSE | |
| +0.4 | stat | RetWriteReq | BOOL | FALSE | |
| +0.5 | stat | RetBusyWrite | BOOL | FALSE | |
| +0.6 | stat | dummy1 | BOOL | FALSE | |
| +0.7 | stat | dummy2 | BOOL | FALSE | |
| +1.0 | stat | FC78Reset | BOOL | FALSE | |
| +1.1 | stat | FC78dummy | BOOL | FALSE | |
| +1.2 | stat | FC78dummy1 | BOOL | FALSE | |
| +1.3 | stat | FC78dummy2 | BOOL | FALSE | |
| +1.4 | stat | FC78dummy3 | BOOL | FALSE | |
| +1.5 | stat | FC12FlankeRead | BOOL | FALSE | |
| +1.6 | stat | ConfOK | BOOL | FALSE | |
| +1.7 | stat | FC78WriteData | BOOL | FALSE | |
| =2.0 | stat | | END_STRUCT | | |
| 74.0 | stat | internStatFC180 | INT | 0 | |
| 76.0 | stat | Zaehler | WORD | W#16#0 | |
| 78.0 | stat | PackKenn | BYTE | B#16#0 | |
| 80.0 | stat | Daten0 | WORD | W#16#0 | PCP service ID |

Table 5-311 FB71 variable declaration

| Address | Declara-tion | Name | Type | Starting Value | Comment |
|---|---|---|---|---|---|
| 82.0 | stat | Dat1 | WORD | W#16#0 | Number of parameter words |
| 84.0 | stat | Dat2 | WORD | W#16#0 | Communication reference |
| 86.0 | stat | Dat3 | WORD | W#16#0 | Packet ID/Index |
| 88.0 | stat | Dat4 | WORD | W#16#0 | Subindex always 0 / byte length of user data |
| 90.0 | stat | Dat5 | WORD | W#16#0 | MPI address - ID/type |
| 92.0 | stat | Dat6 | WORD | W#16#0 | MPI address - number |
| 94.0 | stat | Dat7 | WORD | W#16#0 | MPI address - partial area (for DB only) |
| 96.0 | stat | data0 | WORD | W#16#0 | MPI address - area / high byte byte address |
| 98.0 | stat | data1 | WORD | W#16#0 | MPI address - 13-bit byte address 3-bit |
| 100.0 | stat | data2 | WORD | W#16#0 | User data for sending data from DW20 to DW66 (48 bytes of user data) |
| 102.0 | stat | data3 | WORD | W#16#0 | |
| 104.0 | stat | data4 | WORD | W#16#0 | |
| 106.0 | stat | data5 | WORD | W#16#0 | |
| 108.0 | stat | data6 | WORD | W#16#0 | |
| 110.0 | stat | data7 | WORD | W#16#0 | |
| 112.0 | stat | data8 | WORD | W#16#0 | |
| 114.0 | stat | data9 | WORD | W#16#0 | |
| 116.0 | stat | data10 | WORD | W#16#0 | |
| 118.0 | stat | data11 | WORD | W#16#0 | |
| 120.0 | stat | data12 | WORD | W#16#0 | |
| 122.0 | stat | data13 | WORD | W#16#0 | |
| 124.0 | stat | data14 | WORD | W#16#0 | |
| 126.0 | stat | data15 | WORD | W#16#0 | |
| 128.0 | stat | data16 | WORD | W#16#0 | |
| 130.0 | stat | data17 | WORD | W#16#0 | |
| 132.0 | stat | data18 | WORD | W#16#0 | |
| 134.0 | stat | data19 | WORD | W#16#0 | |
| 136.0 | stat | data20 | WORD | W#16#0 | |
| 138.0 | stat | data21 | WORD | W#16#0 | |
| 140.0 | stat | data22 | WORD | W#16#0 | |

Table 5-311 FB71 variable declaration

| Address | Declara-tion | Name | Type | Starting Value | Comment |
|---|---|---|---|---|---|
| 142.0 | stat | data23 | WORD | W#16#0 | |
| 144.0 | stat | data24 | WORD | W#16#0 | |
| 146.0 | stat | data25 | WORD | W#16#0 | End of received user data |
| 148.0 | stat | data26 | WORD | W#16#0 | Write service ID |
| 150.0 | stat | data27 | WORD | W#16#0 | Number of parameter words |
| 152.0 | stat | data28 | WORD | W#16#0 | Communication reference |
| 154.0 | stat | Data29 | WORD | W#16#0 | Packet ID/Index |
| 156.0 | stat | Data30 | WORD | W#16#0 | Number/subindex |
| 158.0 | stat | Data31 | WORD | W#16#0 | User data or 1 byte error code + high byte error code |
| 160.0 | stat | Data32 | WORD | W#16#0 | User data or low byte error subcode |
| 162.0 | stat | data33 | WORD | W#16#0 | Only user data up to DW124 |
| 164.0 | stat | datum1 | WORD | W#16#0 | |
| 166.0 | stat | Datum2 | WORD | W#16#0 | |
| 168.0 | stat | Datum3 | WORD | W#16#0 | |
| 170.0 | stat | Datum4 | WORD | W#16#0 | |
| 172.0 | stat | Datum5 | WORD | W#16#0 | |
| 174.0 | stat | Datum6 | WORD | W#16#0 | |
| 176.0 | stat | Datum7 | WORD | W#16#0 | |
| 178.0 | stat | Datum8 | WORD | W#16#0 | |
| 180.0 | stat | Datum9 | WORD | W#16#0 | |
| 182.0 | stat | Datum10 | WORD | W#16#0 | |
| 184.0 | stat | Datum11 | WORD | W#16#0 | |
| 186.0 | stat | Datum12 | WORD | W#16#0 | |
| 188.0 | stat | Datum13 | WORD | W#16#0 | |
| 190.0 | stat | Datum14 | WORD | W#16#0 | |
| 192.0 | stat | Datum15 | WORD | W#16#0 | |
| 194.0 | stat | Datum16 | WORD | W#16#0 | |
| 196.0 | stat | Datum17 | WORD | W#16#0 | |
| 198.0 | stat | Datum18 | WORD | W#16#0 | |
| 200.0 | stat | Datum19 | WORD | W#16#0 | |
| 202.0 | stat | Datum20 | WORD | W#16#0 | |

Table 5-311 FB71 variable declaration

| Address | Declaration | Name | Type | Starting Value | Comment |
|---|---|---|---|---|---|
| 204.0 | stat | Datum21 | WORD | W#16#0 | End of transmission user data |
| 206.0 | stat | Pollb_Reserve | BYTE | B#16#0 | Poll area for operating device (reserve) |
| 207.0 | stat | Pollb_Koordinier | BYTE | B#16#0 | Poll area for operating device (coordination byte) |
| 208.0 | stat | Pollb_Meldekanal | WORD | W#16#0 | Poll area for operating device (serial message channel) |
| 210.0 | stat | Abbild_Maskennum | INT | 0 | Current mask number of operating device |
| 212.0 | stat | Uhr_Jahr | BYTE | B#16#0 | Set real-time clock in operating device |
| 213.0 | stat | Uhr_Monat | BYTE | B#16#0 | Set real-time clock in operating device |
| 214.0 | stat | Uhr_Tag | BYTE | B#16#0 | Set real-time clock in operating device |
| 215.0 | stat | Uhr_Stunde | BYTE | B#16#0 | Set real-time clock in operating device |
| 216.0 | stat | Uhr_Minute | BYTE | B#16#0 | Set real-time clock in operating device |
| 217.0 | stat | Uhr_Sekunde | BYTE | B#16#0 | Set real-time clock in operating device |
| 218.0 | stat | Uhr_Sync_Trigger | BOOL | FALSE | Auxiliary bit for clock synchronization |
| 218.1 | stat | BusBreak | BOOL | FALSE | |

#### 5.18.6.1.4 Function Block FB171

In function block FB171, function block FB71 is called separately for each operating device and the parameters for each individual operating device are transferred.

In the variable declaration table for FB171, you must enter the FB71 for each operating device. It must be entered as a multiple instance in the static area of the column "Type.

The following example for a declaration table contains three entries for operating devices. In the column "Type", the entry "FB71" is automatically replaced by the entry "SuetronPanel".

**Call instruction:** `CALL FB171, DB171`

Table 5-312 Variable declaration for FB171

| Address | Declara-tion | Name | Type | Starting Value | Comment |
|---|---|---|---|---|---|
| 0.0 | stat | BereichsDaten | ARRAY[1..7] | | |
| *2.0 | stat | | WORD | | |
| 14.0 | stat | Pult_1 | "SuetronPanel" | | 1st operating device |
| 234.0 | stat | Pult_2 | "SuetronPanel" | | 2nd operating device |
| 454.0 | stat | Pult_3 | "SuetronPanel" | | 3rd operating device |

In the variable “BereichsDaten” with a field size of 7 words, function FC78 saves the starting address and quantity of data requested by the operating device. This information is used to execute a range check. The field is also used as a buffer.

You can declare 62 multiple instance entries of the FB71 type (SuetronPanel) consecutively without gaps.

You must NOT alter the declaration table structure until after the multiple instance entries!

#### 5.18.6.1.5 Function FC3

The function FC3 calls the Phoenix Contact function FC13 IB_DIAG to determine the bus status.

If the bus is started again following an error, function FC3 registers the new status of the INTERBUS. The function block FB71 then initiates a new connection setup.

**Call instruction:** `CALL „IB_Diagnose`

The function FC3 has no parameters.

#### 5.18.6.1.6 Function FC8

The function FC8 calls up the system function SFC51 “RDSYSST” to determine the CPU-specific memory areas. These are stored in DB8 starting from data word 240. The data are now available for the range check.

**Call instruction:** `Call „ReadAKZ“`

The function FC8 has no parameters.

#### 5.18.6.1.7 Function FC11 "INIT_IB"

The function FC11 initializes the INTERBUS data block IBDB with the required data. The timer T1 is used in this function.

The function FC11 is called once in the start-up organization blocks OB100 and OB101.

**Call instruction** `Call FC 11`

Table 5-313 Parameters for the function FC11

| Parameter | Value | Description |
|---|---|---|
| IN_IBDB | 13 | Number of the global INTERBUS data block. The function FC11 parameterizes the IBDB |
| IN_COM_ADR | 1276 | S7 base address of the controller board Must be located above the peripheral address 1000. |
| IN_DIAG_STATE | 1048 | S7 address of the diagnostic status register |
| IN_DIAG_PARA | 1050 | S7 address of the diagnostic parameter register |
| IN_FKN_START | 1054 | S7 address of the standard function start register |
| IN_FKN_PARA | 1056 | S7 address of the standard function parameter register |
| IN_FKN_STATE | 1058 | S7 address of the standard function status register |
| IN_MEM_READ | 12 | Block number of the FC MEM_READ |
| IN_MEM_WRITE | 14 | Block number of the FC MEM_WRITE |
| IN_LOAD | 0 | Configuration of the controller board 0 = Load configuration from parameterization memory (from Flash card)1 = Load configuration through function blocks of the application (IB_ADRSS)2 = Load configuration through a CMD file and data blocks |
| IN_BOOT | 0 | Bus system start 0 = Start from the configuration 1 = Start with the configuration frame 1 from the application (the number of the configuration frame to be activated and to be started is transferred with the parameter "BOOT") |
| IN_MODE | 0 | Operating mode of the controller board (standard = 0)0 = A_SYN (asynchronous mode)1 = IB_SYN (synchronous mode - INTERBUS-controlled)2 = A_SYN (asynchronous) with synchronization pulse as an interrupt |
| IN_TIMER_NR | T1 | Number of a timer used by FC11 |
| IN_SOURCE | 0 | Number of the parameterization data block for IN_LOAD = 2. |

Table 5-313 Parameters for the function FC11

| Parameter | Value | Description |
|---|---|---|
| IN_CONFIGURATION | DW#16#0 | Bit0 = 0 = The FC IB_DIAG enters PF entries into the IBDB Bit0 = 1 = The FC IB_DIAG does not enter PF entriesBit1 = 0 = The FC IB_DIAG enters USER entries into the IBDB Bit1 = 1 = The FC IB_DIAG does not enter USER entriesBit2 = 0 = The FC IB_DIAG enters BUS entries into the IBDB Bit2 = 1 = The FC IB_DIAG does not enter BUS entriesBit3 = 0 = The FC IB_DIAG enters CTRL entries into the IBDB Bit3 = 1 = The FC IB_DIAG does not enter CTRL entriesBit4 = 0 = No data consistency for input and output data (FC21/22 mode 0-9)Bit4 = 1 = Data consistency for input and output data (FC21/22 mode 0-9)Bit31 = 0 = S7-400 DSC in direct mode of operation (S5-ADAPTOR)Bit31 = 1 = S7-400 DSC in extended mode of operation - Only the address entries of the parameter COM_ADR are required - all other addresses are preset. In COM_ADR, you specify the base address of the "FM451 FIX SPEED" entered during parameterization of the S7 hardware. |
| OUT_RET | #FC11Ret | Result bit - If the result bit is set, the DBW56 of the IBDB contains an error code with the following meaning:1 = Timeout2 = Negative result for "Stop and request new configuration" 3 = Negative result for "Start data transfer" 4 = Parameter LOAD not valid 5 = Communication register not addressable (may be wrong base address, HWdefect)6 = Error in parameterization sequence (in SOURCE parameter)— DBW76 of the IBDB contains the displayed diagnostics status register — DBW78 of the IBDB contains the displayed diagnostics parameter register— DBW74 of the IBDB contains the service code with the error; it is used for internal purposes. |
| INOUT_BUSY | #FC11Busy | Function active - is set by the user as an edge bit. This bit must be set during call-up. |

#### 5.18.6.1.8 Function FC12 "MEM_READ"

The function FC12 activates the handshake between the controller board and the connected operating devices.

The function FC12 is called once when entering the OB1 cycle with mode 10.

The bit #FC12BusyBit must already be set when the function is called up. Otherwise no action will be taken.

To set the bit #FC12BusyBit:

```
UN #FC12BusyBitS #FC12BusyBit
```

**Call instruction**

```
Call FC 12
```

Table 5-314 Parameters for the function FC12

| Parameter | Value | Description |
|---|---|---|
| IN_IBDB | 13 | Number of the global INTERBUS data block. |
| IN_MODE | 10 | Operating mode of the controller board; here always the value 10 |
| IN_SOURCE | 0 | Number of the parameterization data block. |
| IN_DEST_AREA | 0 | Data destination area |

Table 5-314 Parameters for the function FC12

| Parameter | Value | Description |
|---|---|---|
| IN_DEST_AREA_NR | 0 | Number of the data block if the destination area = data. |
| IN_DEST_OFFSET | 0 | Start address in data destination area |
| IN_DEST_LENGTH | 0 | Number of words to be read |
| OUT_RET | #FC12RetBit | Result bit - If the bit is set, the DBW58 of the IBDB contains an error code with the following meaning:1 = "DB0" has been specified as the destination in DEST_AREA_NR 2 = Invalid parameter specified in DEST_AREA 3 = Invalid operating mode specified in MODE 4 = Invalid CR number specified in SOURCE (number of an PCP-enabled INTERBUS participant)5 = A data set that has not been activated in IBS CMD has been specified |
| INOUT_BUSY | #FC12Busy Bit | Function active - is set by the user as an edge bit. This bit must be set when the call is carried out. |

#### 5.18.6.1.9 Function FC13 "IB_DIAG"

The function FC13 processes the error messages of the INTERBUS together with the internal functions of the controller board. The function FC13 evaluates the bits Periphery Fail, User, Bus and Controller Error of the diagnostic status register. The data corresponding to the error are stored in the IBDB. The parameter CONFIGURATION of the function FC11 is used to determine whether error data should be stored in the IBDB and if so, which error data.

After a BUS or CTRL error, bit 2 of the standard function start register is initiated using the parameters START_UP, ACTIVATE or AUTO_START.

The START_UP parameter is set in the start-up organization block.

A button can be addressed to the ACTIVATE parameter and depending on the diagnostic status register, both parameters initiate bit 0 or 2 of the standard function start register.

**Call instruction** `Call FC 13`

Table 5-315 Parameters for the function FC13

| Parameter | Value | Description |
|---|---|---|
| IBDB | DB | Global INTERBUS data block, length = 840 words |
| ACTIVATE | BOOL | Acknowledgement button |
| AUTO_START | BOOL | Automatic restart0 = only the ACTIVATE parameter can set bit 0 or 2 1 = bit 0 or 2 of the standard function start register is automatically set in the event of an error. If the error cannot be removed, bits 0 or 2 are reactivated at preset intervals (interval in DBW98 of the IBDB) |
| RUN | BOOL | 0 = INTERBUS is in STOP state 1 = INTERBUS is in RUN state |
| PF | BOOL | 0 = INTERBUS without peripheral fault1 = INTERBUS indicates a peripheral fault. The participant number is stored in the diagnostics parameter register. |
| BUS_QUALITY | BOOL | 0 = High transmission quality 1 = Configured number of errors exceeded |

Table 5-315 Parameters for the function FC13

| Parameter | Value | Description |
|---|---|---|
| DETECTION | BOOL | 0 = No bus error 1 = Searching for bus error |
| BUSY_STATE | BOOL | Function active. |
| RET | BOOL | Result bit |
| START_UP | BOOL | INTERBUS start after controller startup |

#### 5.18.6.1.10 Function FC14 "MEM_WRITE"

The function FC14 deactivates the handshake between the controller board and the connected operating devices.

The function FC14 is called once with Mode 10 when exiting the OB1 cycle.

The bit #FC14BusyBit must already be set when the function is called up. Otherwise no action will be taken.

To set the bit #FC14BusyBit:

```
UN #FC14BusyBitS #FC14BusyBit
```

**Call instruction**

```
Call FC 14
```

Table 5-316 Parameters for the function FC14

| Parameter | Value | Description |
|---|---|---|
| IN_IBDB | 13 | Number of the global INTERBUS data block. |
| IN_MODE | 10 | Operating mode of the controller board; here always the value 10. |
| IN_SOURCE_AREA | 0 | Data source area |
| IN_SOURCE_AREA_NR | 0 | Number of the data block if the source area = data. |
| IN_SOURCE_OFFSET | 0 | Start address in data source area. |
| IN_SOURCE_LENGTH | 0 | Number of words to be written. |
| IN_DESTINATION | 0 | Data destination |
| OUT_RET | #FC14RetBit | Result bit - If the bit is set, the DBW60 of the IBDB contains an error code with the following meaning:1 = "DB0" has been specified as the source in SOURCE_AREA_NR 2 = Invalid parameter specified in "SOURCE_AREA"3 = Invalid operating mode specified in "MODE" 4 = Invalid CR number specified in "DESTINATION" (number of an PCP-enabled INTERBUS participant)5 = A data set that has not been activated in IBS CMD has been specified |
| INOUT_BUSY | #FC14Busy Bit | Function active - is set by the user as an edge bit. This bit must be set when the call is carried out. |

#### 5.18.6.1.11 Function FC18 "IB_SERV"

The function FC18 sends services to the controller board and receives the response.The response is evaluated and the RETURN bit set or not set, accordingto the result of the evaluation..

Services to be sent are located in data block IN_SOURCE_NR starting from address IN_SOURCE_DW_NR.

Received responses are located in data block IN_DEST_NR starting from address IN_DEST_DW_NR.

Before you can use this function for a maximum of 126 PCP participants (CR2 to CR127) and for system management (CR0), you must make a note of the FC execution status for each CR. This is carried out by the parameter INOUT_INTERNAL which must be parameterized with the static variable "internStatFC180" for this CR. This way, only those resources needed for the number of PCP participants connected are used.

A toggle bit is used in this case so that a timer does not have to be reserved for each PCP participant. This toggle bit has a clock pulse rate in seconds, simulating a timer.

This toggle bit must be used!

**Call instruction** `Call FC 18`

Table 5-317 Parameters for the function FC18

| Parameter | Value | Description |
|---|---|---|
| IN_IBDB | INT | Number of the global INTERBUS data block. |
| IN_SOURCE_DB_NR | INT | Number of the data block that contains the service to be sent |
| IN_SOURCE_DW_NR | INT | DBW start address in the transmission data block |
| IN_CR_NR | INT | CR number of the PCP participant (2 to 127) |
| IN_DEST_DB_NR | INT | Number of the data block in which the service to be received is entered |
| IN_DEST_DW_NR | INT | DBW start address in the receive data block |
| IN_TOGGLE | BOOL | Second bit (0.5 s = 0 and 0.5 s = 1) |
| OUT_RET | BOOL | Result bit - If the bit is set, the DBW62 of the IBDB contains an error code with the following meaning:1 = Timeout2 = Wrong confirmation code3 = Negative result6 = The variable INTERNAL was changed outside of the FC |
| INOUT_BUSY | BOOL | Function active - is set by the user as an edge bit.This bit must be set when the call is carried out. |
| INOUT_INTERNAL | INT | Internal status of function FC18. |

#### 5.18.6.1.12 Function FC19 "GETCONF"

The function FC19 reads service data from the controller board and copies the data to the specified destination data block of the controller.

If the related notification bit is set in the IBDB, this function retrieves the confirmation and copies it to the DEST_DB_NR starting from DEST_OFFSET.

The INOUT_BUSY bit is only reset if a valid service is received. This means that the INOUT_BUSY bit remains set until confirmation is received on the parameterized CR.

**Call instruction** `Call FC 19`

Table 5-318 Parameters for the function FC19

| Parameter | Value | Description |
|---|---|---|
| IN_IBDB | INT | Number of the global INTERBUS data block. |
| IN_CR_NR | INT | CR number of the PCP participant (2 to 127) |
| IN_DEST_DB_NR | INT | Number of the data block in which the service to be received is entered |
| IN_DEST_OFFSET | 74 | DBW start address in the receive data block |
| OUT_RET | BOOL | Result bit - If the bit is set, the DB13.DBW58 of the IBDB contains an error code with the following meaning:1 = "DB0" has been specified as the destination in DEST_AREA_NR 2 = not used 3 = not used 4 = Invalid CR number specified in IN_CR_NR (number of an PCP-enabled INTERBUS participant) |
| INOUT_BUSY | BOOL | Function active - is set by the user as an edge bit.This bit must be set when the call is carried out. |

#### 5.18.6.1.13 Function FC78

The FC78 function decodes the MPI address which supplies the information report.

In case of a write command, FC78 writes the supplied data to the corresponding area.

In case of read command, FC78 writes the requested data to the transmission area and indicates with bit ToggleBits.FC78WriteData that data are pending transfer.

**Call instruction:** `Call FC 78`

Table 5-319 Parameters for the function FC78

| Parameter | Value | Description |
|---|---|---|
| Source_DB | #QuellDb | Number of the receive data block. Contains the value of the operand "Source_DB" of FB71. |
| Source_Offset | #Quellen Abstand | Offset in the receive data block starting from which the information report is entered. Contains the value of the operand "Source_Offset" of FB71. |
| Dest_DB | #ZielDb | Number of the receive data block. Contains the value of the operand "Dest_DB" of FB71. |
| Dest_Offset | #ZielAbstand | Offset in the receive data block starting from which the information report is entered. Contains the value of the operand "Dest_Offset" of FB71. |
| InstDB | #InternDB | Number of the instance data block. Contains the value of the operand "Inst_DB" of FB71. |
| Schreiben | #ToggleBits.FC78WriteData | 0 = Information report was received1 = Data are to be transmitted |

Table 5-319 Parameters for the function FC78

| Parameter | Value | Description |
|---|---|---|
| ResetKomm | #ToggleBits.FC78Reset | Reserved |
| FehlerNummer | #Fehlernummer1 | 0 = no error occurred150 to 186 = error |
| FehlerNummerSubcode | #FehlerUnterNummer | Specifies the first element after which an error has occurred. This element may be located in the valid range. If this is the case, the range has been exceeded. |

#### 5.18.6.1.14 System Function SFC51 "RDSYSST"

The SFC51 system function determines the address ranges that are permitted or authorized in the CPU for the PABB of the inputs and outputs, flags, counters and times, and makes them available for the range check. In this process, the function supplies more information than is strictly necessary. The SFC51 system function enters the information that is not required into data block DB8 (starting from data word DW240).

The SFC51 system function is called in the FC8 function within the OB100/OB101.

## 5.19 Jetter

The Jetter protocol offers random read and write access to all data of the controller.

The PASE and PCOM5 protocols permit access to only one variable at a time. To be able to access linear data blocks, the TesiMod operating device fragments block-oriented accesses into single accesses.

The TesiMod operating device only has read access to the inputs of the controller.

Access to alphanumeric text is only possible with data type T. In this case, the operating device does not manage length or status information. The text data are located linearly in the 3-byte registers.

The size of the address area depends on the controller being used.

The protocol supports a connection to all controllers which are supported by the PASE and PCOM5/7 protocols such as the following controller types.

– PASE Mikro,
– PASE-E,
– Delta,
– Nano,
– JetControl.

### 5.19.1 Data Types

Direct access is possible to the following data types.

Table 5-320 Jetter data types

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | E | Bit Access |
| Output Bit | A | Bit Access |
| Flag Bit | M | Bit Access |
| 24-Bit Signed Integer Register or | R | 24-Bit Data |
| 32-Bit Real Register | R | 32-Bit Data |
| 32-Bit Real Register | G | 32-Bit Data |
| 24-Bit Text Register | T | 24-Bit Data |

#### 5.19.1.1 Address Definition

The upper limit for the address depends on the respective controller and is listed in the controller's manual.

Table 5-321 Valid addresses for Jetter (input/output/flag)

| Storage Location | Mnem. | PASE-E | Delta | Mikro | Nano | JetControl |
|---|---|---|---|---|---|---|
| Input | E | Slot 1 to 655Channel 1 to 16 | Slot 1 to 655Channel 1 to 64 | 1 to 16 | Slot 1 to 6551 to 8 | Slot 1 to 655Channel 1 to 16 |
| Output | A | Slot 1 to 655Channel 1 to 16 | Slot 1 to 655Channel 1 to 64 | 1 to 16 | Slot 1 to 6551 to 8 | Slot 1 to 655Channel 1 to 16 |
| Flag | M | 0 to 65535 | 0 to 65535 | 0 to 65535 | 0 to 65535 | 0 to 65535 |

Table 5-322 Register addresses for PASE-E

| Storage Location | Mnem. | PASE-E | PASE-Mikro | Number of Bytes for Register Variables |
|---|---|---|---|---|
| Text | T | 0 to 8959 | 0 to 8959 | 3 |
| Integer | R | 0 to 8959 | 0 to 8959 | 3 |
| Real | R | 8950 to 9215 | --- | 4 |

Table 5-323 Register addresses for PCOM5/7

| Storage Location | Mnem. | PASE-E | Delta | Nano | Number of Bytes for Register Variables |
|---|---|---|---|---|---|
| Text | T | 0 to 15728639 | 0 to 15728639 | 0 to 15728639 | 3 |
| Real | G | 0 to 15728639 | 0 to 15728639 | 0 to 15728639 | 4 |
| Real | R | 8950 to 9215 | 62208 to 62463 | 65024 to 65279 | 4 |
| Integer | R | 0 to 8959, 9215 to 15728639 | 0 to 62207,62464 to 5728639 | 0 to 65023, 65280 to 15728639 | 3 |

Table 5-324 Register Addresses for JetControl

| Storage Location | Mnem. | JetControl | Number of Bytes for Register Variables |
|---|---|---|---|
| Text | T | 0 to 15728639 | 4 |

Table 5-324 Register Addresses for JetControl

| Storage Location | Mnem. | JetControl | Number of Bytes for Register Variables |
|---|---|---|---|
| Real | G | 0 to 15728639 | 4 |
| Real | R | 65024 to 65279 | 4 |
| Integer | R | 0 to 64023, 65280 to 15728639 | 4 |

## 5.19.2 Programming

### 5.19.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.19.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-325 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.19.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-326 Parity

| Configurable Values | Default Value |
|---|---|
| None | X (PASE) |
| Even | X (PCOM5/7) |
| Odd | |

#### 5.19.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-327 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.19.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-328 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.19.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-329 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.19.2.1.6 Maximum Waiting Time For Response

This parameter specifies the number of stop bits.

Table 5-330 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 500 ms (PASE)<br>1000 ms (PCOM5/7) |

#### 5.19.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-331 Delay until connection set-Up

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 10000 ms |

#### 5.19.2.1.8 Jetter CPU Type

This parameter specifies which controller is used.

Table 5-332 Jetter CPU type

| Configurable Values | Default Value |
|---|---|
| PASE-Mikro | |
| PASE-E | X |

Table 5-332 Jetter CPU type

| Configurable Values | Default Value |
|---|---|
| Delta | |
| Nano | |
| JetControl | |

#### 5.19.2.1.9 Jetter Protocol Type

This parameter specifies which protocol is used for communication.

Table 5-333 Jetter protocol type

| Configurable Values | Default Value |
|---|---|
| PASE-E | |
| PCOM5/7 | X |

#### 5.19.2.1.10 Structure of Poll Area/Status Messages

This parameter specifies whether the full data length is used for the poll area and the status messages.

Table 5-334 Structure of poll area/status messages

| Configurable Values | Default Value |
|---|---|
| 16 out of 24 Bits | |
| Full Length | X |

#### 5.19.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

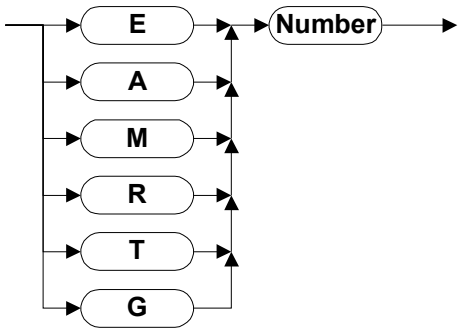



Figure 5-51 Syntax diagram

#### 5.19.2.3 System Parameters

##### 5.19.2.3.1 Poll Area

The poll area is used to manage the write coordination byte (WCB), the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

Assign this data area to a 24-bit or a 32-bit integer register variable. This variable represents the data area's start address. Depending on the protocol parameter settings, only the lower two bytes of the 24-bit or 32-bit registers are used. However, in TSwin you simply enter the actual length. TSwin then automatically increases the length by the number of bytes not used.

The poll area can have the following structure:

Table 5-335 Poll area 16 out of 24 bits

| Register No. | High Byte | Mid Byte | Low Byte |
|---|---|---|---|
| Register +0 | --- | Write Coordination Byte | Reserved |
| Register +1 | --- | Serial Message Channel High Byte | Serial Message Channel Low Byte |
| Register +2 | --- | LED 1 to 4 | LED 5 to 8 |
| Register +3 | --- | LED 9 to 12 | LED 13 to 16 |
| Register +4 | --- | LED 17 to 20 | LED 21 to 24 |
| Register +5 | --- | LED 25 to 28 | LED 29 to 32 |

Table 5-336 Poll Area 16 Out of 32 Bits (Full Length)

| Register No. | Highest Byte | High Byte | Low Byte | Lowest Byte |
|---|---|---|---|---|
| Register +0 | --- | --- | Write Coordination Byte | Reserved |
| Register +1 | --- | --- | Serial Message Channel High Byte | Serial Message Channel Low Byte |
| Register +2 | --- | --- | LED 1 to 4 | LED 5 to 8 |

Table 5-336 Poll Area 16 Out of 32 Bits (Full Length)

| Register No. | Highest Byte | High Byte | Low Byte | Lowest Byte |
|---|---|---|---|---|
| Register +3 | --- | --- | LED 9 to 12 | LED 13 to 16 |
| Register +4 | --- | --- | LED 17 to 20 | LED 21 to 24 |
| Register +5 | --- | --- | LED 25 to 28 | LED 29 to 32 |

#### 5.19.2.3.2 Status Messages

Status messages are the static assignment of bits in the controller to plain text messages in the operating device. The principles that apply to the addressing are the same as those for the poll area.

The area for the status messages can have the following structure:

Table 5-337 Status messages 16 out of 2

| Register No. | High Byte | Mid Byte | Low Byte |
|---|---|---|---|
| Register +0 | --- | Message 16 to 9 | Message 8 to 1 |
| Register +1 | --- | Message 32 to 25 | Message 24 to 17 |
| Register +2 | --- | Message 48 to 41 | Message 40 to 33 |

Table 5-338 Status messages 24 out of 24

| Register No. | High Byte | Mid Byte | Low Byte |
|---|---|---|---|
| Register +0 | Message 24 to 17 | Message 16 to 9 | Message 8 to 1 |
| Register +1 | Message 48 to 41 | Message 40 to 33 | Message 32 to 25 |
| Register +2 | Message 72 to 65 | Message 64 to 57 | Message 56 to 49 |

Table 5-339 Status Messages 32 out of 32 (Full Length)

| Register No. | Highest Byte | High Byte | Low Byte | Lowest Byte |
|---|---|---|---|---|
| Register +0 | Message 32 to 25 | Message 24 to 17 | Message 16 to 9 | Message 8 to 1 |
| Register +1 | Message 64 to 57 | Message 56 to 49 | Message 48 to 41 | Message 40 to 33 |
| Register +2 | Message 96 to 89 | Message 88 to 81 | Message 80 to 73 | Message 72 to 65 |

### 5.19.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.19.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-340 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.19.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-341 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

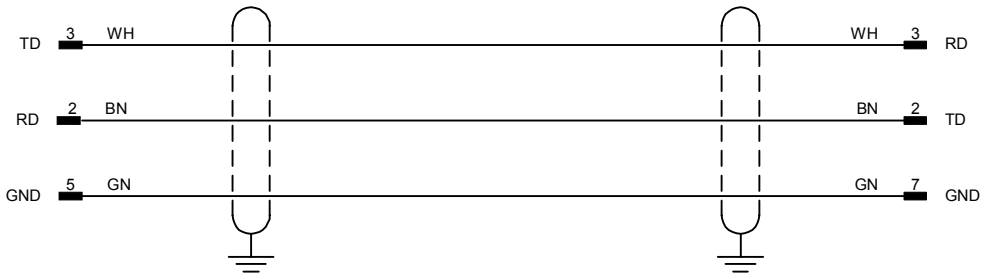
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.19.3.3 Cable X3 SER1 RS232 - Jetter

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Jetter
PASE-E, Mikro,
Nano, Delta, Jet-
Control




D-SUB
male connector
25 pin

D-SUB
male connector
9 pin

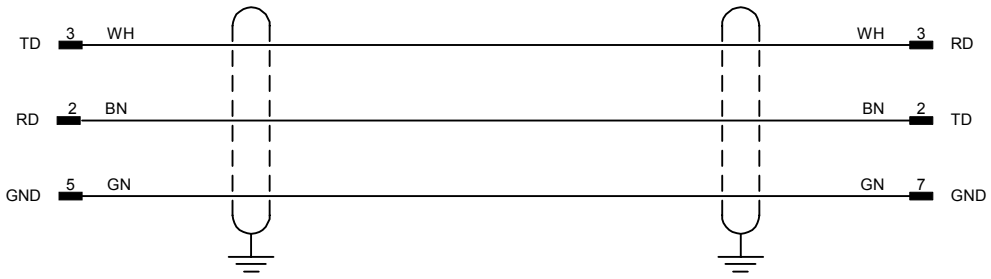
Both ends of the shield are connected to the metallic housing.

#### 5.19.3.4 Cable X2 RS232 - Jetter

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Jetter
PASE-E, Mikro, Nano, Delta, Jet-Control




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

Both ends of the shield are connected to the metallic housing.

### 5.19.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-342 Jetter error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | |
| 2 | | Wrong characters received | |
| 3 | | Error in protocol frame | |
| 10 | | No cyclic data defined | |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| 50 | | Unauthorized write access to inputs | |
| 51 | | Controller does not respond with the expected 32-bit data, but with 24-bit data | |
| PCOM5-specific error messages | | | |
| 52 | | No STX (0xDA) at the beginning of the telegram | |
| 53 | | Request telegram contains invalid parameter | Status bit 1 |
| 54 | | Request telegram contains invalid command | Status bit 2 |
| 55 | | Timeout | Status bit 3 |
| 56 | | General error in status | Status bit 4 |
| 57 | | Error receiving request telegram | Status bit 6 |
| 58 | | Controller does not respond with the expected 24-bit data, but with 32-bit data | |

## 5.20 Mitsubishi FX

The Mitsubishi FX protocol allows you random read and write access to all data of the controller.

All byte-oriented data types can also be accessed in bit-mode.

Connect the operating device to the programming device interface of the controller. An additional communication module is not required.

### 5.20.1 Data Types

Direct access is possible to the following data types.

Table 5-343 Mitsubishi FX data types

| Type | Mnemonic | Access |
|---|---|---|
| Input | X | Bit/Byte Access |
| Output | Y | Bit/Byte Access |
| Flag (special flag also) | M | Bit/Byte Access |
| Timer Flag | T | Bit/Byte Access |
| Timer Value | T | Word Access |
| Counter Flag | C | Bit/Byte Access |
| Counter Value | C | Word Access |
| Step Status Operand | S | Bit/Byte Access |
| Data Register (also special data register) | D | Word/Double Word Access |

## 5.20.2 Programming

### 5.20.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.20.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-344 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.20.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-345 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.20.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-346 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.20.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-347 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

#### 5.20.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-348 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.20.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-349 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 5000 ms |

#### 5.20.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-350 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 100 ms to 65535 ms | 10000 ms |

#### 5.20.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

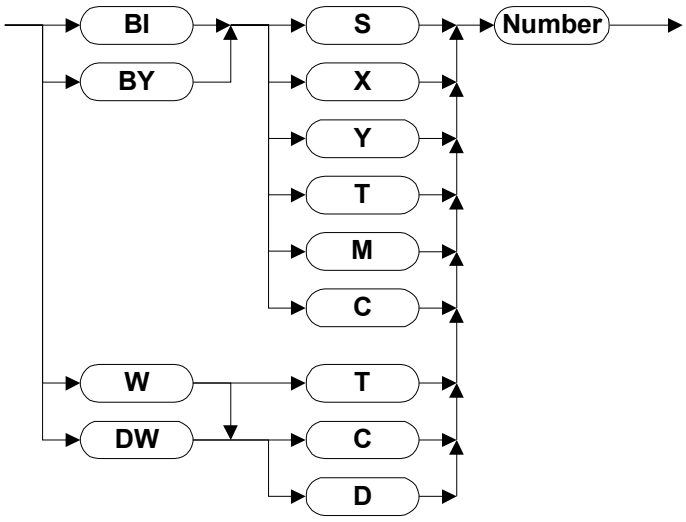



Figure 5-52 Syntax diagram

### 5.20.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.20.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-351 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.20.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-352 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

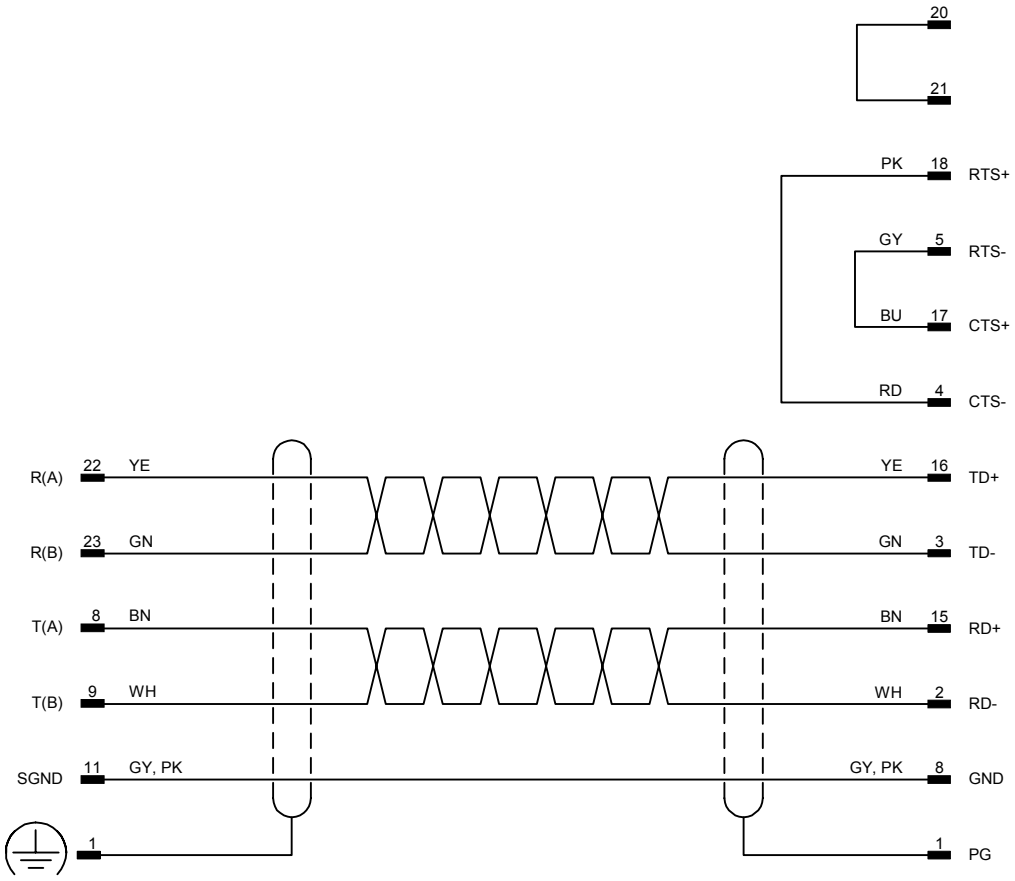
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.20.3.3 Cable X3 SER1 RS485 - Mitsubishi FX

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Mitsubishi
FX series




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

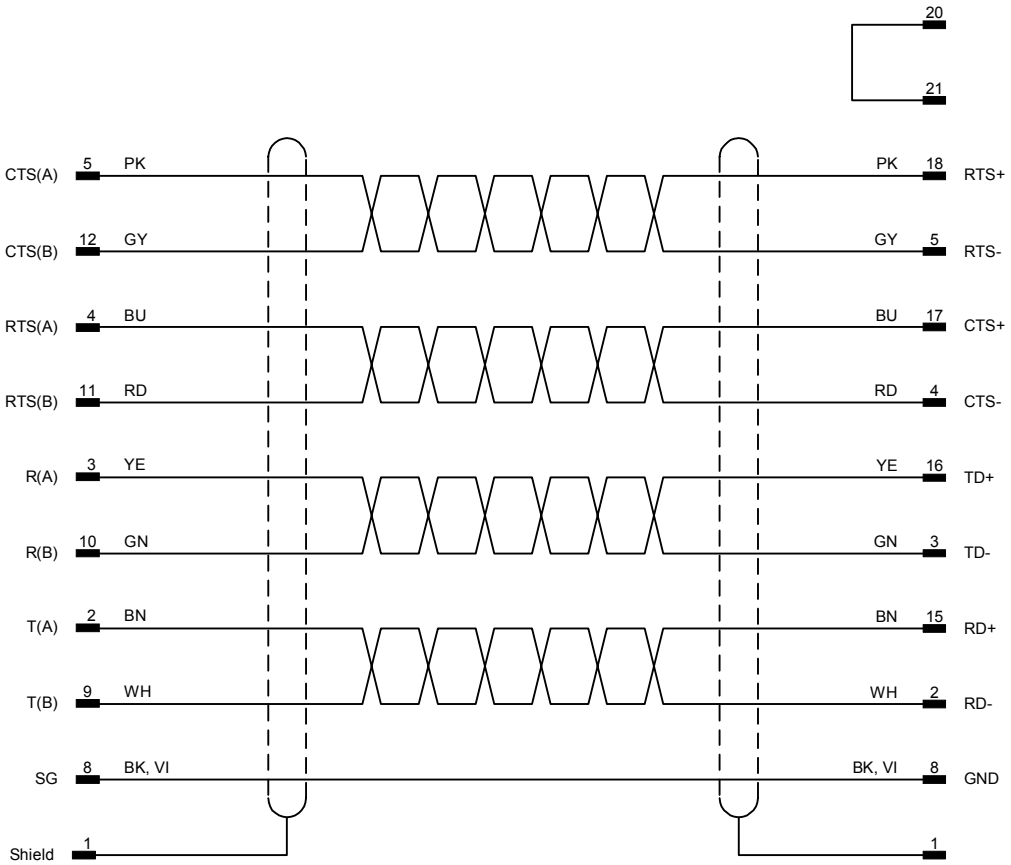
Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

#### 5.20.3.4 Cable X2 RS485 - Mitsubishi FX

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Mitsubishi
FX series




D-SUB
male connector
15 pin

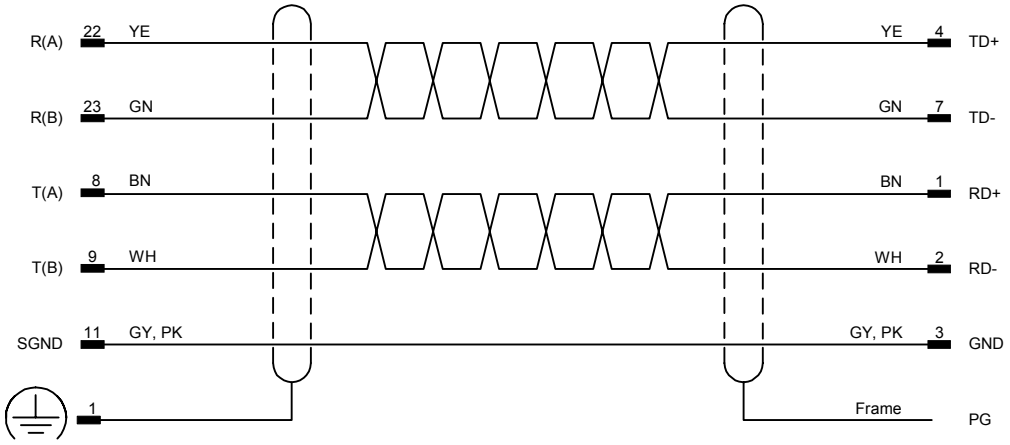
D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

### 5.20.3.5 Cable X3 SER1 RS485 - Mitsubishi FX0

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device — Mitsubishi FX0




D-SUB
male connector
25 pin

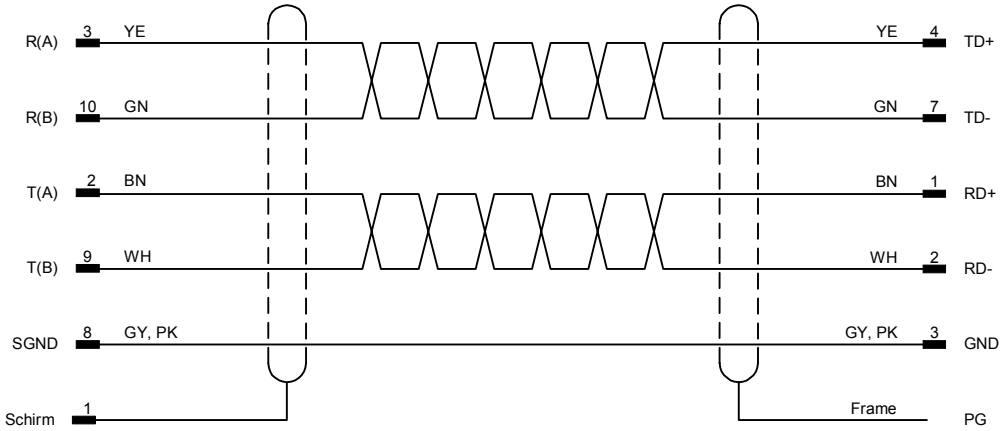
MINI-DIN
male connector
8 pin

Both ends of the shield are connected to the metallic housing.

#### 5.20.3.6 Cable X2 RS485 - Mitsubishi FX0

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device — Mitsubishi FX0




D-SUB
male connector
15 pin

MINI-DIN
male connector
8 pin

Both ends of the shield are connected to the metallic housing.

### 5.20.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-353 Mitsubishi FX/FX0 error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 4 | | Waiting time elapsed (Timeout) | Connection broken. |
| 5 | | CRC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 17 | | NAK from controller | |
| 40 | | System variable error | Undefined system variable |

## 5.21 Mitsubishi MelsecA

The Mitsubishi Melsec A protocol provides you random read and write access to all data of the controller.

All bit operands can also be accessed in bit-mode.

Connect the TesiMod operating device to the AJ71C24 communication module of a controller of the An/AnA series.

### 5.21.1 Data Types

Direct access is possible to the following data types.

Table 5-354 Mitsubishi MelsecA data types

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | BX | Bit Access |
| Input Word | WX | Word Access |
| Output Bit | BY | Bit Access |
| Output Word | WY | Word Access |
| Flag Bit | BM | Bit Access |
| Flag Word | WM | Word Access |
| Latch Flag Bit | BL | Bit Access |
| Latch Flag Word | WL | Word Access |
| Step Flag Bit | BS | Bit Access |
| Step Flag Word | WS | Word Access |
| Link Flag Bit | BB | Bit Access |
| Link Flag Word | WB | Word Access |
| Error Flag Bit | BF | Bit Access |
| Error Flag Word | WF | Word Access |
| Timer Contact Bit | BTS | Bit Access |
| Timer Contact Word | WTS | Word Access |
| Timer Coil Bit | BTC | Bit Access |
| Timer Coil Word | WTC | Word Access |
| Timer Actual Value Word | WTN | Word Access |
| Timer Actual Value Double-Word | DWTN | Double-Word Access |
| Counter Contact Bit | BCS | Bit Access |
| Counter Contact Word | WCS | Word Access |
| Counter Coil Bit | BCC | Bit Access |
| Counter Coil Word | WCC | Word Access |

Table 5-354 Mitsubishi MelsecA data types

| Type | Mnemonic | Access |
|---|---|---|
| Counter Actual Value Word | WCN | Word Access |
| Counter Actual Value Double-Word | DWCN | Double-Word Access |
| Data Register Word | WD | Word Access |
| Data Register Double-Word | DWD | Double-Word Access |
| Link Register Word | WW | Word Access |
| Link Register Double-Word | DWW | Double-Word Access |
| File Register Word | WR | Word Access |
| File Register Double-Word | DWR | Double-Word Access |

## 5.21.2 Programming

### 5.21.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.21.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-355 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.21.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-356 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.21.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-357 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.21.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-358 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.21.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-359 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.21.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-360 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 1000 ms |

#### 5.21.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-361 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 0 s to 20 s | 2 s |

#### 5.21.2.1.8 Mitsubishi CPU Type

This parameter indicates the CPU type which is used in the connected controller.

Table 5-362 Mitsubishi CPU type

| Configurable Values | Default Value |
|---|---|
| An-CPU | X |
| AnA-CPU | |

#### 5.21.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

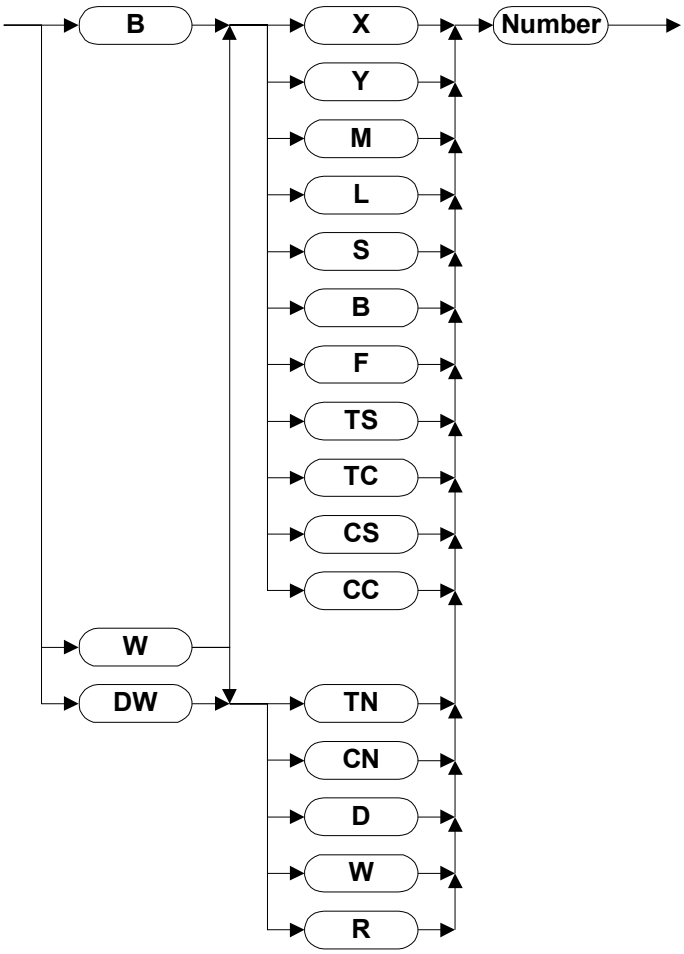



Figure 5-53 Syntax diagram

### 5.21.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.21.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-363 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.21.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-364 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

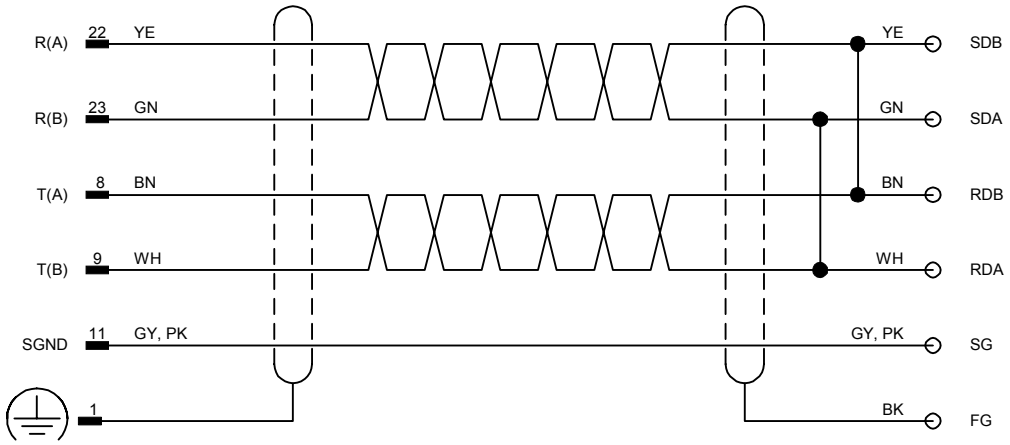
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.21.3.3 Cable X3 SER1 RS485 - Mitsubishi MelsecA

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Mitsubishi
MelsecA




D-SUB
male connector
25 pin

D-SUB
male connector
25 pin

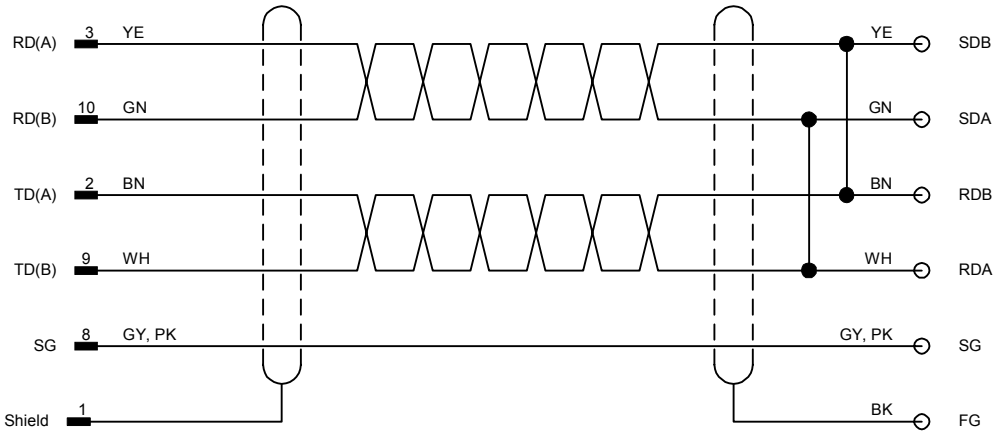
Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

### 5.21.3.4 Cable X2 RS485 - Mitsubishi MelsecA

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Mitsubishi MelsecA




D-SUB
male connector
15 pin

D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

### 5.21.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-365 Mitsubishi MelsecA error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 5 | | CRC error | |
| 6 | | Wrong parity | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| Error messages from the controller (AJ71C24) | | | |
| 50 | | No function in RUN-mode | The respective DIP switch is not in ON position.To be able to write parameters, CPU must be in STOP mode. |
| 51 | | Parity error | DIP switch for parity is not set correctly |
| 52 | | Checksum error | DIP switch for checksum is not set correctly |
| 53 | | Protocol error | Mode switch does not correspond to the required protocol-format. |
| 54 | | Runtime error | DIP switch for the number of stop bits is not set correctly |
| 55 | | Data overrun | New data were transmitted before the preceding transmissionwas completed. |
| 56 | | Character set error | Invalid operand address or requested service not available or wrong CPU type specified. |
| 57 | | Character error | Characters transmitted do not correspond to the valid characterset. |

Table 5-365 Mitsubishi MelsecA error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 58 | | Faulty access to CPU | This PLC type can not be used with the AJ71C24 |
| 66 | | Incorrect number assignment | The CPU number does not correspond to the value FFH. |
| 67 | | Mode error | Faulty communication between AJ71C24 and the CPU. |
| 68 | | Incorrect assignment of special module | An interactive special module equipped with its own buffer wasconfigured improperly. |
| 69 | | Incorrect step number in PLC program | A step control instruction is out of the range parameterized for the CPU or the subprogram to be executed is invalid. |
| 74 | | Remote error | Remote RUN/STOP operation is not possible. |
| 82 | | Data link error | An attempt was made to access a station to which communication has already been disconnected. |
| 83 | | Data bus error at special module | Memory of a special module can not be accessed. |

# 5.22 MMICOM

## 5.22.1 Integration of the Operating Devices

INTERBUS is an open field bus concept that is supported by a number of manufacturers of sensor technology and actuator devices. This means that, in addition to using the same bus to connect to the operating devices, several other participants can be connected to the controller (for example, decentralized inputs and outputs).

The operating device is integrated as a slave in the 2-wire remote bus. In this context, the operating device occupies a data width of 4 words or 8 bytes on the INTERBUS. The controller maps each operating device with 8 bytes IN data and 8 bytes OUT data in the memory map.

If the Physical Addressing operating mode is selected in the controller board, the participants' input and output areas are placed sequentially in the memory of the controller in the same order that they are physically installed in the bus.

If the Logical Address operating mode is selected in the controller board, the location of the input and output areas can be placed freely in the controller memory. The location of these areas is also independent of the sequence of bus participants.

## 5.22.2 MMICOM Profile

The MMICOM profile distinguishes between the following three basic data channels on the INTERBUS:

1. Direct process data channel
2. Indirect process data channel
3. Parameter channel.

### 5.22.2.1 Direct Process Data Channel

Direct process data is cyclical data that remains constant while the device is in operation. They are not acknowledged and are incorporated cyclically into the process data channel (for example, 16 inputs of an input module or bit information of a key field - device class A1 or B1).

### 5.22.2.2 Indirect Process Data Channel

Indirect process data is data that does not remain constant while the device is in operation, and changes depending on external events or requirements. Process data identifiers (PD index) are used to determine the structure of this data. The handshake between both communication partners is defined using a status/control byte.

### 5.22.2.3 Parameter Channel

In addition to the process data channel, the parameter channel allows an FMS-like background communication to be carried out. In this context, the bytes of a saved log are sequentially transferred via the INTERBUS. This process is usually advantageous for slower communication processes where larger data volumes are being used, and it does not delay the equidistant transfer of time-critical data.

## 5.22.3 Connecting the Operating Device

In the INTERBUS, the operating device is run in the indirect process data channel. Neither the parameter channel nor the direct process data channel is used. The user data is interpreted in accordance with the MMICOM profile.

The connection to the bus is implemented using dc-decoupled RS485 drivers. The actual bus protocol is handled by the INTERBUS protocol chip.

On the controller side, a manufacturer-specific INTERBUS master controller board is required, preferably with dc-decoupling.

If the controller board in the controller has an 8-wire remote bus interface (25 pin), use the bus terminal IBS 24 BK/LC2 to convert to the 2-wire remote bus (9 pin).

Both the INTERBUS connection and the MMICOM protocol are independent of the controller. As a result, only variable numbers and no real controller addresses are transferred in the MMICOM protocol. The variable number is referenced to the variable in the controller.

A function block must be called in the controller's main program. This function block is assigned the parameters for the location of the IN and OUT data, and must be called for each connected operating device. If necessary, the function block interpretes the requests received from the operating device. In this context, either a read or a write function is carried out, which makes the assignment between the variable number and the actual controller variable. If necessary, the data is copied in the controller in an event-controlled manner. As a result, the controller has a say in what data is written and read by the operating device.

All services (requests) required to run the operating device originate in the operating device. The operating device has client functionality. The controller only reacts to the requests of the operating device, and therefore fulfils the functions of a server.

#### 5.22.3.1 Specification for INTERBUS

The following parameters are used to run operating devices on the INTERBUS:

Table 5-366 Parameters for the operating devices on the INTERBUS

| Parameter | | Value |
|---|---|---|
| Width of the Data Channel | Indirect Process Data with Status Word | 4 Words / 8 Bytes |
| | Direct Process Data | None |
| | Parameter Channel | None |
| Identcode | PD Channel with Input and Output Data | $2F_h$ / $47_d$ |
| Function group specification within the MMICOM | B3 | Variable Input |
| | G1 | Variable Request |
| MMICOM Services Used | PD-Index 0x14 | Write Variable 1 Byte (Mandatory) |
| | PD-Index 0x15 | Write Variable 2 Bytes (Mandatory) |
| | PD-Index 0x16 | Write Variable 4 Bytes |
| | PD-Index 0x40 | Read Variable 1 Byte (Mandatory) |
| | PD-Index 0x41 | Read Variable 2 Bytes (Mandatory) |
| | PD-Index 0x42 | Read Variable 4 Bytes |
| | PD-Index 0x84 | Write Bit to Byte |
| | PD-Index 0x85 | Write Bit to Word |

## 5.22.4 Programming

To select the correct interface variant in the programming software, take note of the ID on the label attached to the operating device.

The two digits after the slash indicate the interface variant (printed in bold in the example displayed below).

**For example:** TP32ET/**16**9032

### 5.22.4.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.22.4.1.1 MMICOM Handshake Timeout

This parameter specifies how long the operating device waits for an acknowledgement from the controller.

Table 5-367 MMICOM handshake timeout

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 100 ms |

#### 5.22.4.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-368 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 0 s to 20 s | 10 s |

#### 5.22.4.1.3 Floating Point Number in the Siemens Format

This parameter specifies whether floating point numbers are exchanged in the Siemens-specific format or IEEE format.

Table 5-369 Floating point number in the Siemens format

| Configurable Values | Default Value |
|---|---|
| IEEE Format | |
| Siemens Format | X |

### 5.22.4.2 System Parameters

Only accesses up to four bytes are supported in the MMICOM profile. You must therefore use several accesses to implement the system parameters **polling area**and **status messages**.

To achieve a defined byte order, you must always use 2-byte accesses to implement the system parameters. Always select the access W (word) when assigning the start-up variable number.

#### 5.22.4.2.1 Poll Area

The polling area is used to manage the write coordination byte (WCB), the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device. The polling area is structured as follows:

Table 5-370 Additional function - polling area, MMICOM

| Bit Number | 15 | 8 | 7 | 0 |
|---|---|---|---|---|
| Variable X | WCB | | Reserved | |
| Variable X+1 | Serial Message Channel High Byte | | Serial Message Channel Low Byte | |
| Variable X+2 | LED 1 to 4 | | LED 5 to 8 | |
| Variable X+3 | LED 9 to 12 | | LED 13 to 16 | |
| Variable X+4 | LED 17 to 20 | | LED 21 to 24 | |
| Variable X+5 | LED 25 to 28 | | LED 29 to 32 | |

#### 5.22.4.2.2 Status Messages

Status messages are the static assignment of flags (bits) in the controller to plain text messages in the operating device.

The area for the status messages has the following structure:

Table 5-371 Status messages, MMICOM

| Bit Number | 15 | 8 | 7 | 0 |
|---|---|---|---|---|
| Variable X | Message 16 to 9 | | Message 8 to 1 | |
| Variable X+1 | Message 32 to 25 | | Message 24 to 17 | |
| Variable X+2 | Message 48 to 41 | | Message 40 to 33 | |

### 5.22.4.3 Data Types

The data types specify how many bytes are assigned to a single variable.

Table 5-372 Data types, MMICOM

| Data Type | Access to | Length of Single Variable | Comment |
|---|---|---|---|
| BY | Byte (and Bit also) | 1 Byte | Next Byte is Located 1 Address Higher |
| W | Word | 2 Bytes | Next Word is Located 1 Address Higher |
| W-2 | Word | 2 Bytes | Next Word is Located 2 Address Higher |

Table 5-372 Data types, MMICOM

| Data Type | Access to | Length of Single Variable | Comment |
|---|---|---|---|
| DW | Double Word | 4 Bytes | Next Double Word is Located 1 Address Higher |
| DW-2 | Double Word | 4 Bytes | Next Double Word is Located 2 Address Higher |
| DW-4 | Double Word | 4 Bytes | Next Double Word is Located 4 Address Higher |

The access parameter determines the data length that is evaluated by the operating device, and the MMICOM service used to handle the variable.

The following convention applies to data with a data length of more than 4 bytes (for example, alphanumeric texts, tables, polling area, status messages):
Depending on the access type, the data is processed with the corresponding one-, two-, or four-byte access. If there is other data to be processed, it is assumed that this data is located under the next higher variable number in each case.

**For example:** A text with ten characters that starts at the variable 100 (access W - word) is made up of the variables 100 to 104.

#### 5.22.4.4 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

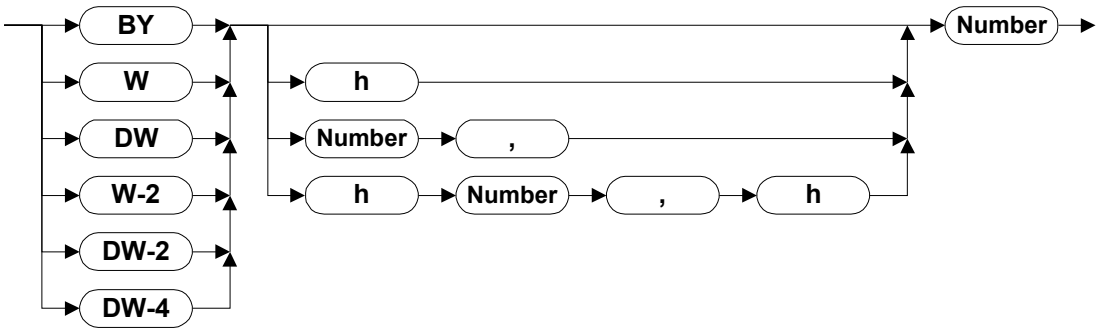



Figure 5-54 Syntax diagram

Variable addresses written with a comma are decoded as follows:

Variable address = Figure 1 (high-byte) x 25610 + figure 2 (low-byte)

You can enter figure 1 and figure 2 as a decimal or hexadecimal, but you must use each to the same base (for example, DW16,16 or DWh10,h10).

##### 5.22.4.4.1 Variable Number

The MMICOM profile is used to assign the data on a controller-independent basis, based on a variable number. A fixed controller address is only assigned to a variable number in the controller (for example, the variable number 50 will be assigned to the flag 32.0). The variable number can either be entered as a decimal (without an ID) or as a hexadecimal (with a leading h).

**Example** Variable number 100 or H64

A linear, ascending variable number area must be reserved for data structures greater than 4 bytes (for example, alphanumeric texts, tables, polling area, status messages). This number area must be determined by the size of the data structure and the access used in each case.

When you start up the operating device, a one-byte read access is carried out on the variable with the number zero. In this context, the data read is not interpreted, and the read function block does not have to decode this variable number.

## 5.22.5 Physical Interfacing

### 5.22.5.1 Pin Assignment

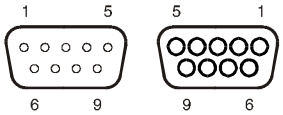



Figure 5-55 9 pin D-SUB male connector strip and female connector strip

Connector in the terminal: 9 pin D-SUB male connector strip for remote bus in.

Table 5-373 Pin assignment remote bus in (INTERBUS)

| Pin | Designation | Function |
|---|---|---|
| 1 | DO | Data Output |
| 2 | DI | Data Input |
| 3 | GND | Ground |
| 4 | nc | Not Connected |
| 5 | nc | Not Connected |
| 6 | /DO | Data Output, Inverted |
| 7 | /DI | Data Input, Inverted |
| 8 | nc | Not Connected |
| 9 | nc | Not Connected |

Connector in the terminal: 9 pin D-SUB female connector strip for remote bus out.

Table 5-374 Pin assignment remote bus out (INTERBUS)

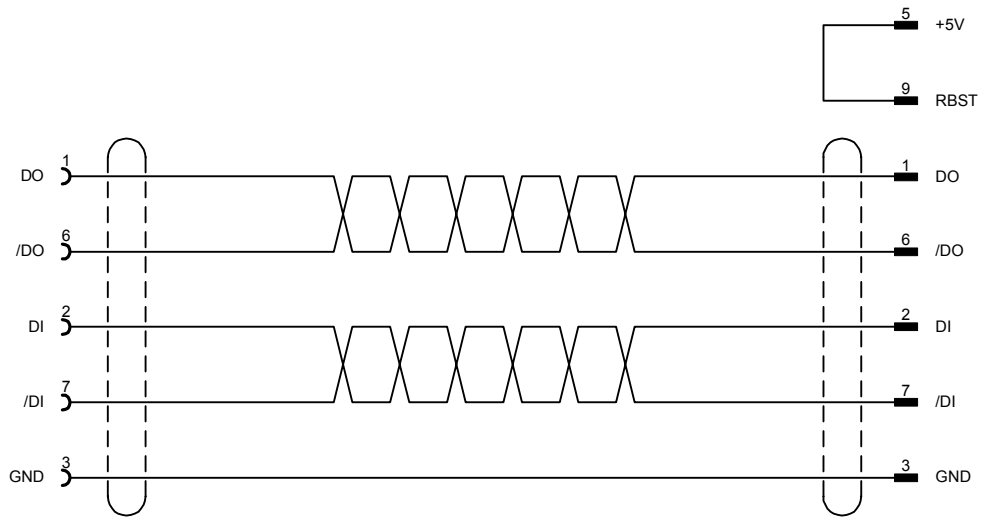
| Pin | Designation | Function |
|---|---|---|
| 1 | DO | Data Output |
| 2 | DI | Data Input |
| 3 | GND | Ground |
| 4 | nc | Not Connected |
| 5 | +5 V | Power Supply +5 VDC |
| 6 | /DO | Data Output, Inverted |
| 7 | /DI | Data Input, Inverted |
| 8 | nc | Not Connected |
| 9 | RBST | Remote Bus Status |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.22.5.2 2-Wire Remote Bus Cable

Operating device
Remote bus IN

Remote bus OUT




D-SUB
male connector
9 pin

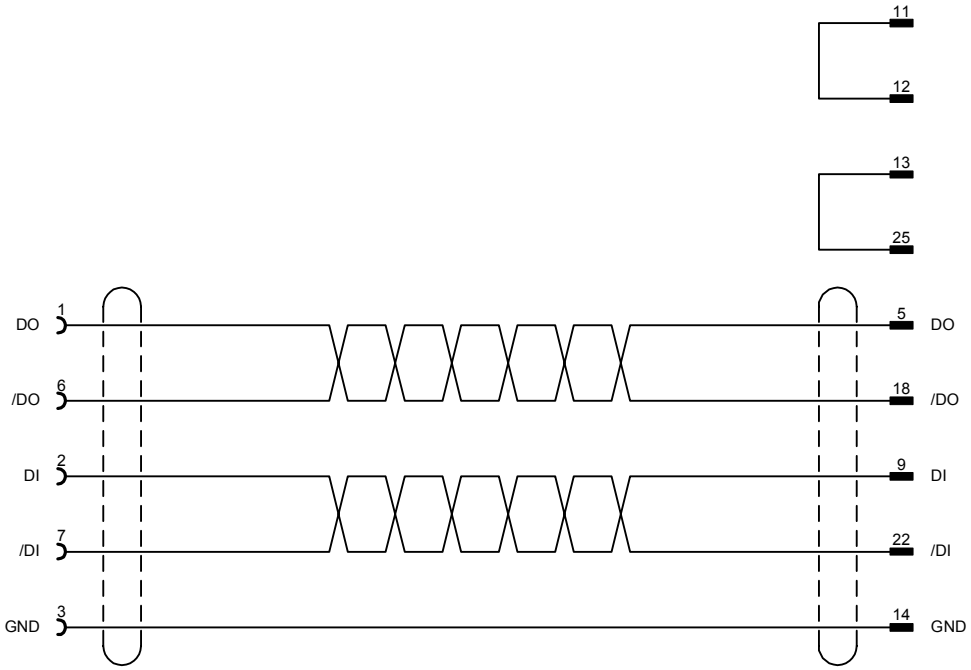
D-SUB
male connector
9 pin

#### 5.22.5.3 Converting from 8-Wire Protocol to 2-Wire Protocol

Using bus terminal IBS 24 BK.

Operating device
Remote bus IN

Remote bus OUT




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

### 5.22.6 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-375 Error Messages - MMICOM

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 2 | | The controller has transferred data to the operating device, but the operating device has not requested the data. The subcode specifies the received PD index in decimal format. | |
| 40 | | Illegal system variable. | The project contains an illegal system variable. |
| 50 | | Malfunction bit not set by controller.The subcode specifies the received PD Index in decimal format. | |
| 51 | | Online bit not set by controller.The subcode specifies the received status control byte in decimal format. | Bus is not running, PLC program is missing or controller is in STOP mode. |
| 52 | | Standard bit and/or index bit not set by controller.The subcode specifies the received status control byte in decimal format. | Bus is not running, PLC program is missing or controller is in STOP mode. |
| 53 | | Wrong PD index received. The subcode specifies the received PD Index in decimal format. | |
| 54 | | Handshake error (receive timeout). The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | PLC program is missing or controller is in STOP mode or the function block for the operating device is not active. |
| 55 | | Handshake error (send timeout). The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | PLC program is missing or controller is in STOP mode. |
| 56 | | Variable has wrong base size. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | Wrong access type specified. |
| 57 | | Handshake error. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | Handshake bits were not set correctly by controller. |

Table 5-375 Error Messages - MMICOM

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 58 | | Access error. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | No valid data cycles are executed on the INTERBUS. |
| 59 | | Wrong variable number received. The subcode indicates the variable number - in decimal format - which was being edited when the error occurred. | The 8 byte user data are not consistent. There is an error within the controller board. |
| 60 | | Wrong PD index received. The subcode specifies the received PD Index in decimal format. | The 8 byte user data are not consistent. There is an error within the controller board. |

By setting up the following system variables in one of the masks in the projects, you can log the error messages with the operating device.

- **ComParityCount** to log the number of the error codes 59.
- **ComOverrunCount** to log the number of the error codes 60.
- **ComFrameCount** to log the number of all other error codes.

## 5.22.7 Applications

### 5.22.7.1 Siemens S7 Controller

#### 5.22.7.1.1 Operating Mode 'Asynchronous'

For the controllers S7-300 and S7-400, the controller boards are normally run in the asynchronous mode of operation.

To set the operating mode with IBS CMD G4, carry out the following steps:

1. Select the controller board.
2. From the context menu, select **Settings**.

The **Controller Board Settings** dialog opens.

3. Open the **Bus Operation** tab.
4. From the **Bus Operation** field, select the **Asynchronous** operating mode.
5. Click **OK** to confirm your settings.

#### 5.22.7.1.2 Operating Mode 'Asynchronous with Synchronization Impulse'

You can operate the INTERBUS on both the S7-300 and the S7-400 in the **asynchronous with synchronization impulse** operating mode.

It is, however, recommended to use the S7-400 in the **asynchronous** mode of operation only.

To set the operating mode 'Asynchronous with Synchronization Impulse", carry out the following steps:

1. Select the controller board.
2. From the context menu, select **Settings**.

The **Controller Board Settings** dialog opens.

3. Open the **Bus Operation** tab.
4. From the **Bus Operation** field, select the operating mode **Asynchronous with Synchronization Impulse**.
5. Click the **Bus Operation Options** button.

The **Bus Operation Options** dialog opens.

6. Select the **Board's Interrupt Mode** check box.

This ensures that the parameters for the process alarm, interrupt line 1 and alarm OB 40 are transferred to the controller system.

7. Click **OK** to confirm your settings.

To parameterize data sets to transfer the process data, carry out the following steps:

1. Select the controller board.
2. From the context menu, select **Settings**.

The **Controller Board Settings** dialog opens.

3. Open the **IBS Data Records** tab.

The **IBS Data Records** tab allows you to specify the following parameters:

Table 5-376 Parameters for IBS data sets

| Parameter | Description |
|---|---|
| Record | Choose the number of the data set you want to specify the parameters for. |
| Area | Specify the destination area (DB, E, M) or the source area (A, DB, M), respectively, in the controller. |
| Data Block | If you selected DB for the destination/source area, enter the number of your target/source data block. |
| Offset (Byte) | Enter the start address of the data to be transferred into the selected target/source area. |
| Length (Byte) | Enter the length of the data to be transferred (8 bytes for operating devices). |

4. Click **OK** to confirm your settings.

#### 5.22.7.1.3 Configuring the Operating Device as an INTERBUS Participant

To add an operating device to the INTERBUS, carry out the following steps:

1. Select the controller board.
2. From the context menu, select **Insert with ID Code**.

The **Insert Device** dialog opens.

3. Enter the **ID code** in either the hexadecimal (**2F**) or decimal format (**47**).
4. Enter the value **8** for the **Process Data Channel**.
5. For the **Device Type** select the **Remote Bus Device** button.
6. Click OK to confirm your input.

The **Device Description** dialog opens. Here you can enter a description of the operating device.

7. Click **OK** to confirm this dialog.

The configuration is complete. Save the configuration to the parameterization memory.

#### 5.22.7.1.4 Phoenix Contact Function Blocks

Phoenix Contact provides the following functions and data blocks for the operating mode 'Asynchronous with Synchronization Impulse':

– FC20 (INIT_IB),
– FC21 (MEM_READ),
– FC22 (MEM_WRIT),
– FC24 (IB_DIAG),
– FC28 (IB_SYNC) and
– DB20 (IBDB).

When operating the S7-300 controller in the operating mode **Asynchronous**, you need the INTERBUS data block also.

#### 5.22.7.1.5 FC20 (INIT_IB)

The FC20 function is called-up once when the controller (OB100) is started-up. It controls the start-up behavior of the controller board and initializes the INTERBUS data block (IBDB, DB20 in the example below) with the required data. The settings for timer T1 are fixed.

**Parameter:**

The busy bit must be set when the function is called up. Otherwise no action will be taken.

```
UN #FC20BusyBit
S #FC21BusyBit
CALL FC 20
 IBDB := DB20
 COM_ADR := 256
 DIAG_STATE := 0
 DIAG_PARA := 0
 FKN_START := 0
 FKN_PARA := 0
 FKN_STATE := 0
 MEM_READ := 21
 MEM_WRITE := 22
 LOAD := 0
 BOOT := 0
 MODE := 0
 TIMER_NR := T1
 SOURCE := 0
 CONFIGURATION := DW#16#8000000F
 RET := #FC20RetBit
 BUSY := #FC20BusyBit
```

Table 5-377 Parameters for the FC20 function

| Parameter | Value | Description |
|---|---|---|
| IBDB | DB20 | Number of the global INTERBUS data block.<br>This is the data block in which the FC20 function specifies the settings. |
| COM_ADR | | S7 base address of the controller board |
| DIAG_STATE | 0 | S7 address for the diagnostic status register.<br>This address depends on the controller board's base address and is assigned automatically. Therefore, enter the value 0 (zero). |
| DIAG_PARA | 0 | S7 address for the diagnostic parameter register.<br>This address depends on the controller board's base address and is assigned automatically. Therefore, enter the value 0 (zero). |
| FKN_START | 0 | S7 address for the standard function start register.<br>This address depends on the controller board's base address and is assigned automatically. Therefore, enter the value 0 (zero). |
| FKN_PARA | 0 | S7 address for the standard function parameter register.<br>This address depends on the controller board's base address and is assigned automatically. Therefore, enter the value 0 (zero). |
| FKN_STATE | 0 | S7 address for the standard function status register.<br>This address depends on the controller board's base address and is assigned automatically. Therefore, enter the value 0 (zero). |

Table 5-377 Parameters for the FC20 function

| Parameter | Value | Description |
|---|---|---|
| MEM_READ | | Block number (21) for the read driver FC21 (MEM_READ) |
| MEM_WRITE | | Block number (22) for the write driver FC22 (MEM_WRITE) |
| LOAD | | The interface's module configuration is loaded. |
| | 0 (Flash) | The configuration is loaded from the parameterization memory. This requires programming through the IBS CMD/parameterization memory. |
| | 1 (APPLIC) | The configuration is loaded through the application's function blocks. |
| | 2 (CMD_IB) | The configuration is loaded via a CMD file and data blocks. |
| IN_BOOT | | This parameter controls the INTERBUS start-up (only applies if LOAD = 0). |
| | 0 | The bus system is started from the configuration (the parameterization stored on the Flash card contains the bus system start-up information). |
| | 1 | The bus system is started with the configuration frame 1 via the initialization driver. |
| MODE | | Operating mode (BA) of the controller board |
| | 0 (A_SYN) | Asynchronous |
| | 1 (A_SYN_IMP) | Asynchronous with synchronization impulse acting as an interrupt |
| TIMER_NR | | Number of the timer used by the function |
| SOURCE | | Number of the parameterization DB for LOAD = 2 |

Table 5-377 Parameters for the FC20 function

| Parameter | Value | Description |
|---|---|---|
| CONFIGURATION | | 32 configuration bits for INTERBUS blocks |
| | Bit 0 = 0 | Peripheral entries (PF entries) are made by the function IB_DIAG in the IBDB. |
| | Bit 0 = 1 | Peripheral entries (PF entries) are not made by the function IB_DIAG in the IBDB. |
| | Bit 1 = 0 | User error entries (USER entries) are made by the function IB_DIAG in the IBDB. |
| | Bit 1 = 1 | User error entries (USER entries) are not made by the function IB_DIAG in the IBDB. |
| | Bit 2 = 0 | Bus error entries (BUS entries) are made by the function IB_DIAG in the IBDB. |
| | Bit 2 = 1 | Bus error entries (BUS entries) are not made by the function IB_DIAG in the IBDB. |
| | Bit 3 = 0 | Controller entries (CTRL entries) are made by the function IB_DIAG in the IBDB. |
| | Bit 3 = 1 | Controller entries (CTRL entries) are not made by the function IB_DIAG in the IBDB. |
| | Bit 4 = 0 | Reserved |
| | Bit 4 = 1 | Reserved |
| | Bit 31 = 0 | Not relevant |
| | Bit 31 = 1 | This bit must always be set. This informs all of the driver blocks that this is a S7-300 DSC controller board. |
| | DW#16#8000000F | No errors are entered into the IBDB. |
| | DW#16#80000000 | All errors are entered into the IBDB. |

Table 5-377 Parameters for the FC20 function

| Parameter | Value | Description |
|---|---|---|
| RET | | When the result bit is set (1), DBW56 of the IBDB contains an error code with the following meaning:<br>High-Byte DBB56 = error number<br>Low-Byte DBB57 = number of the defective step |
| | Error number 1 | Timeout |
| | Error number 2 | Negative result for 'Stop and reconfiguration request' |
| | Error number 3 | Negative result for 'Start data transfer' |
| | Error number 4 | Parameter 'LOAD' invalid. |
| | Error number 5 | Communication register cannot be read (basic address is set incorrectly or hardware defective) |
| | Error number 6 | Error in parameterization sequence (SOURCE parameter):<br>– The diagnostic status register displayed is entered in the IBDB at DBW 76.<br>– The diagnostic parameter register displayed is entered in the IBDB at DBW 78.<br>– The incorrect service code is entered in the IBDB at DBW 74 and is used for internal purposes. |
| BUSY | 1 | Function active. This bit must be set during call-up. |

#### 5.22.7.1.6 FC21 (MEM_READ)

The function FC21 (MEM_READ) reads data from the controller board and copies it to the specified destination area of the controller.

**Parameter:**

The number of the INTERBUS data block (IBDB, in the following example: DB20) is transferred as a parameter. The busy bit must be set when the function is called up. Otherwise no action will be taken.

```
UN #FC21BusyBit
S #FC21BusyBit
CALL FC21
 IBDB := DB20
 MODE := 1
 SOURCE := 0
 DEST_AREA := 0
 DEST_AREA_NR := 0
 DEST_OFFSET := 0
 DEST_LENGTH := 0
 RET := #FC21RetBit
 BUSY := #FC21BusyBit
```

Table 5-378 Parameters for the FC21 function

| Parameter | Value | Description |
|---|---|---|
| IBDB | DB20 | Number of the global INTERBUS data block. Here it is DB20. |
| MODE | 1 | The function's operating mode.Here it is mode 1 (Reading from data set 1). This must be parameterized in the IBS CMD. |
| SOURCE | 0 | Data source. Not relevant in mode 1. Always 0. |
| DEST_AREA | 0 | Data destination area. Not relevant in mode 1. Always 0. |
| DEST_AREA_NR | 0 | Number of the data block if the destination area = data.Not relevant in mode 1. Always 0. |
| DEST_OFFSET | 0 | Start address in the destination area (DEST_AREA). Not relevant in mode 1. Always 0. |
| DEST_LENGTH | 0 | Number of words to be read. Not relevant in mode 1. Always 0. |
| RET | | Result bit. When the result bit is set, the DBW58 of the IBDB contains an error code with the following meaning: DBW58 = error number 1 to 5. |
| | Error number = 1 | The DEST_AREA_NR parameter has been used to specify 'DB0' as the destination. |
| | Error number = 2 | The DEST_AREA parameter has been used to specify an invalid destination area. |
| | Error number = 3 | The MODE parameter has been used to specify an invalid operating mode. |
| | Error number = 4 | An invalid CR number (number for a PCP-enabled INTERBUS participant) has been specified in the parameter SOURCE. |
| | Error number = 5 | A data set not enabled (activated) in IBS CMD has been specified. |
| Busy | 1 | Function active. This bit must be set during call-up. |

#### 5.22.7.1.7 FC22 (MEM_WRIT)

The function FC22 writes data from the controller's source area to the specified destination area on the controller board.

**Parameter:**

The number of the INTERBUS data block (IBDB, in the following example: DB20) is transferred as a parameter. The busy bit must be set when the function is called up. Otherwise no action will be taken.

```
UN #FC22BusyBit
S #FC22BusyBit
CALL FC 22
 IBDB := DB20
 MODE := 1
 SOURCE_AREA := 0
 SOURCE_AREA_NR := 0
 SOURCE_OFFSET := 0
 SOURCE_LENGTH := 0
 DESTINATION := 0
 RET := #FC22RetBit
 BUSY := #FC22BusyBit
```

Table 5-379 Parameters for the FC22 function

| Parameter | Value | Description |
|---|---|---|
| IBDB | DB20 | Number of the global INTERBUS data block. Here it is DB20. |
| MODE | 1 | The function's operating mode. Here: mode 1 (writing to data set 1).This must be parameterized in IBS CMD. |
| SOURCE_AREA | 0 | Data source. Not relevant in mode 1. Always 0. |
| SOURCE_AREA_NR | 0 | Number of the data block if the source area = data. Not relevant in mode 1. Always 0. |
| SOURCE_OFFSET | 0 | Start address in the SOURCE_AREA. Not relevant in mode 1. Always 0. |
| SOURCE_LENGTH | 0 | Number of words to be written. Not relevant in mode 1. Always 0. |
| DESTINATION | 0 | Data destination. Not relevant in mode 1. Always 0. |
| RET | | Result bit. When the result bit is set, the DBW60 of the IBDB contains an error code with the following meaning: DBW60 = error number 1 to 5. |
| | Error number = 1 | The SOURCE_AREA_NR parameter has been used to specify 'DB0' as the source. |
| | Error number = 2 | The SOURCE_AREA parameter has been used to specify an invalid source area. |
| | Error number = 3 | The MODE parameter has been used to specify an invalid operating mode. |
| | Error number = 4 | An invalid CR number (number for a PCP-enabled INTERBUS participant) has been specified in the parameter DESTINATION. |
| | Error number = 5 | A data set not enabled (activated) in IBS CMD has been specified. |
| Busy | 1 | Function active. This bit must be set during call-up. |

#### 5.22.7.1.8 FC28 (IB_SYNC)

The function FC28 controls the protocol in the operating mode 'Asynchronous with Synchronization Impulse' and monitors the transfer of consistent data greater than 16 bit. In addition, it requires functions for reading and writing I/O data (FC50 and FC51 in the following example). These functions must be programmed without parameters.

**Parameter:**

```
Call FC 28
 IBDB := DB20
 READ_FC := FC50
 WRITE_FC := FC51
 RET := M10.1
```

Table 5-380 Parameters for the FC28 function

| Parameter | Value | Description |
|---|---|---|
| IBDB | DB20 | Number of the global INTERBUS data block. Here it is DB20. |
| READ_FC | | Function to be called to read the input data. |
| WRITE_FC | | Function to be called up to write the output data. |
| RET | 0 | Function was executed with no errors. |
| | 1 | Error. The function was exited. |

#### 5.22.7.1.9 Function Blocks from Sütron electronic

Unlike an S5 controller, the S7 controller has a byte structure in all memory areas. This means that you must use the following designations for variables with more than four bytes in the controller:

W-2 instead of W for:

– The polling area
– The parallel message system
– The time update from and to the controller
– The recipe buffer

DW-4 instead of DW for:

– Alphanumeric variables; The length of the variable must be divisible by four.

If a variable with a memory space requirement of more than four bytes is inadvertently assigned the incorrect data ID, the user data is incorrectly interpreted. The variable does not issue any correct values.

Caution :

When you are starting up the operating device, a one-byte read access is carried out on the variable with the number zero in a test communication. The data read is not interpreted, that is, the read function block does not have to decode this variable number.

#### 5.22.7.1.10 Decoding the Variable Number

The function blocks' write and read function decodes the received variable number as follows:

**For example:** W h 4BC8

| 4 | | | | B | | | | C | | | | 8 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| 15 | 14 | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
| Data Block Number | | | | | | | | Byte/word/double-word number | | | | | | | |

| Abbreviation | Value | Description |
|---|---|---|
| W | | Data Width |
| | DW | Double Word = 32 Bits |
| | DW-4 | Double Word = 32 Bits |
| | W | Word = 16 Bits |
| | W-2 | Word = 16 Bits |
| | BY | Byte = 8 Bits |
| | W | Bit access to word address (if bit address is specified) |
| | BY | Bit access to byte address (if bit address is specified) |
| h | | Hexadecimal Number |
| 4BC8 | | Numeric Code for Data ID<br>4B = Data Block Number (here: DB75)<br>C8 = Double-Word/Word/Byte Number (here: Word 200) |

#### 5.22.7.1.11 Overview of Function Blocks from Sütron electronic

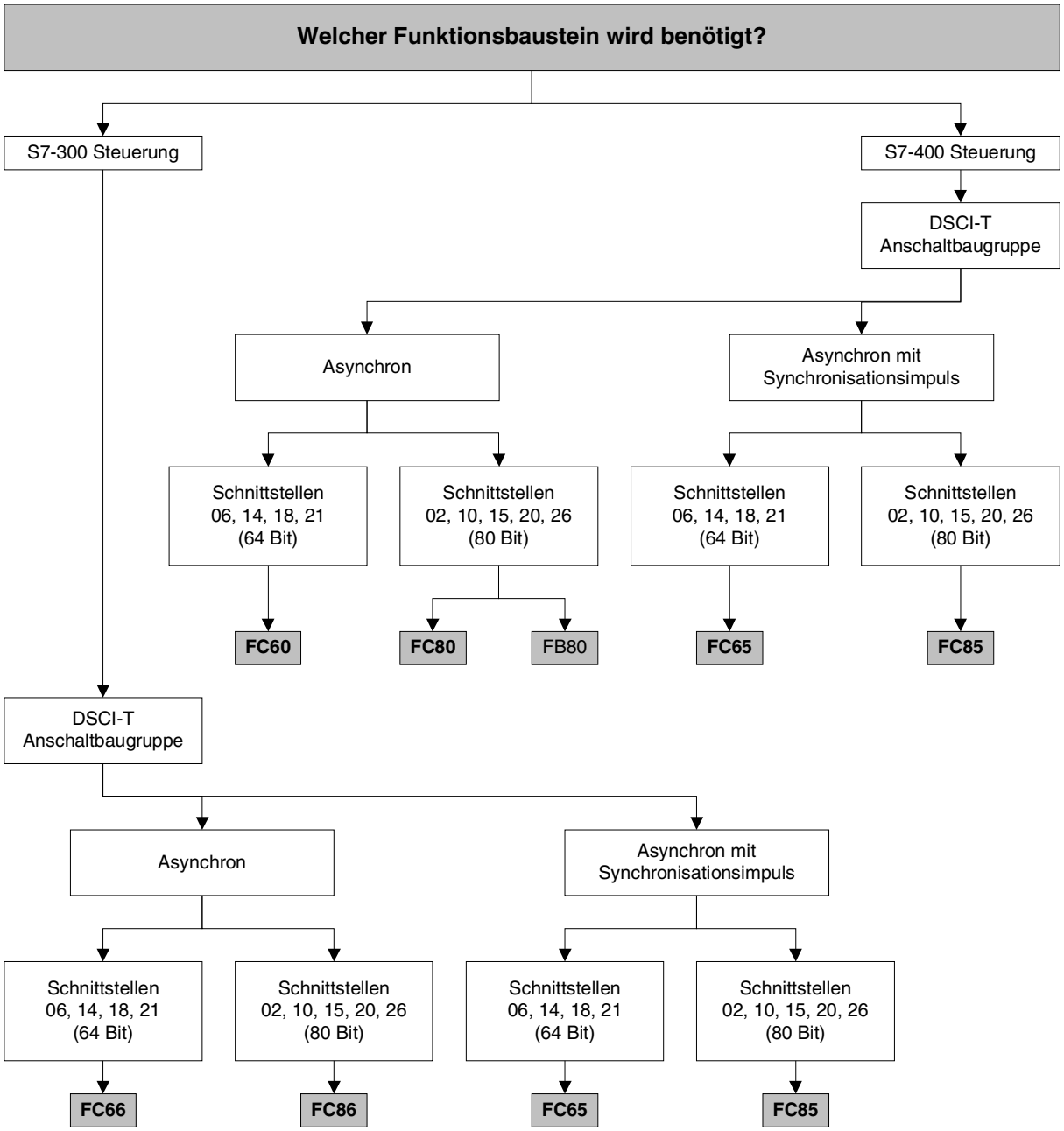



Figure 5-56 Overview of function blocks from Sütron electronic

#### 5.22.7.1.12 Inserting Sources and Function Blocks

The supplied Sütron STL files are imported into the SIMATIC Manager using the entry **Sources**. To do this, select the menu item **External Source** from the menu **Insert**.

The function blocks required depend on the controller type and the connection of the operating device (see diagram).

The files are located in the programming software directory under:

…\FBs\Interbus\SIEMENS\S7\MMI COM Schnittstelle [02,10,15,20,26]\S7-300

…\FBs\Interbus\SIEMENS\S7\MMI COM Schnittstelle [02,10,15,20,26]\S7-400

…\FBs\Interbus\SIEMENS\S7\MMI COM Schnittstelle [06,14,18,21]

The numbers in the square brackets indicate the operating device's interface type.

The imported STL sources must subsequently be converted to the S7 function block format using the STL Editor.

Sütron's functions and function blocks use the register-indirect, cross-area addressing technique. If interrupt-controlled program calls are permitted in the program cycle, the contents of the address registers 1 and 2, and possibly also the local data stack, may need to be saved, in addition to the contents of both accumulators. For more information, see the section on how to avoid errors when calling function blocks (Vermeiden von Fehlern beim Aufrufen von Bausteinen)" in the programming manual for your S7 controller (system software S7-300/400, program design).

The operating device can access the controller data on a bit, byte, word, or doubleword basis. Bit access is possible on a byte or word address. As the MMICOM profile itself does not transfer data type IDs, these are transferred using the variable numbers. Each variable is uniquely identified using a variable number. This number is defined during programming in the programming software.

The functions must be called cyclically in the application program. A separate function block must be called for each connected operating device.

#### 5.22.7.1.13 FC60 for the Operating Mode 'Asynchronous' with S7-400

This function decodes the data transferred by the operating device, and executes read and write accesses accordingly. The data width is 8 bytes. To optimize the transfer time, the function block directly accesses the peripheral addresses and not the process image.DBOFFSET and VAROFFSET also permit access to data blocks and byte addresses greater than 255.

**Parameter:**

```
Call FC 60
 PIN := P#P10.0
 POUT := P#P10.0
 DEST := P#DB101.DBX0.0 Byte 8
 SOURCE := P#DB101.DBX8.0 Byte 8
 VAROFFSET := 0
 DBOFFSET := 0
```

Table 5-381 Parameters for the FC60 function

| Parameter | Value | Description |
|---|---|---|
| PIN | P#P10.0 | Start address of the P inputs of the operating device (Example: P#P10.0 = PEB10) |
| POUT | P#P10.0 | Start address of the P outputs of the operating device (Example: P#P10.0 = PAB10) |
| DEST | | Memory address of the input data. This address must NOT be overwritten by other program parts. |
| SOURCE | | Memory address of the output data. This address must NOT be overwritten by other program parts. |
| DBOFFSET | | DB offset which is added to the data block address of the variables. |
| VAROFFSET | | Variable offset which is added to the byte address of the variables. |

#### 5.22.7.1.14 FC66 for the Operating Mode 'Asynchronous' with S7-300

This function decodes the data transferred by the operating device, and executes read and write accesses accordingly. The data width is 8 bytes.

DBOFFSET and VAROFFSET also permit access to data blocks and byte addresses greater than 255.

**Parameter:**

```
Call FC 66
 PIN := 10
 POUT := 10
 IBDB := DB20
 DEST := DB10.DBX0.0
 SOURCE := DB10.DBX8.0
 VAROFFSET := 0
 DBOFFSET := 0
```

Table 5-382 Parameters for the FC66 function

| Parameter | Value | Description |
|---|---|---|
| PIN | 10 | Offset within the INTERBUS input data (start address of the operating device's input data)<br>(Example: 10 = E10) |
| POUT | P#P10.0 | Start address of the P outputs of the operating device<br>(Example: P#P10.0 = PAB10) |
| IBDB | DB20 | INTERBUS data block |
| DEST | | Destination address of the operating device's data in the controller |
| SOURCE | | Source address of the operating device's data in the controller |
| DBOFFSET | | DB offset which is added to the data block address of the variables. |
| VAROFFSET | | Variable offset which is added to the byte address of the variables. |

#### 5.22.7.1.15 FC80 for the Operating Mode 'Asynchronous' with S7-400

An instance data block must be specified when the function block is called up. The protocol data for inputs and outputs stored in this block are only visible to the FB88.

This function block decodes the data transferred by the operating device, and executes read and write accesses accordingly. The data width is 10 bytes. The function block access the peripheral addresses directly.

DBOFFSET and VAROFFSET also permit access to data blocks and byte addresses greater than 255.

Each of the available I/O points of the module are mapped to byte position 10 in the IN and OUT frame of the module and are not influenced by the function block.

**Parameter:**

```
Call FB 80, DB101
 P_IN := 10
 P_OUT := 10
 DBOFFSET := 0
 VAROFFSET := 0
```

Table 5-383 Parameters for the FC80 function

| Parameter | Value | Description |
|---|---|---|
| P_IN | 10 | Start address of the operating device's inputs (INTEGER)<br>(Example: 10 = PEB10) |
| P_OUT | 10 | Start address of the operating device's outputs<br>(Example: 10 = PAB10) |
| IBDB | DB20 | INTERBUS data block |
| DEST | | Destination address of the operating device's data in the controller |
| SOURCE | | Source address of the operating device's data in the controller |
| DBOFFSET | | DB offset which is added to the data block address of the variables. |
| VAROFFSET | | Variable offset which is added to the byte address of the variables. |

#### 5.22.7.1.16 FC86 for the Operating Mode 'Asynchronous' with S7-300

This function decodes the data transferred by the operating device, and executes read and write accesses accordingly. The data width is 10 bytes.

DBOFFSET and VAROFFSET also permit access to data blocks and byte addresses greater than 255.

**Parameter:**

```
Call FC 86
 PIN := 10
 POUT := 10
 IBDB := DB20
 DEST := DB10.DBX0.0
 SOURCE := DB10.DBX10.0
 DBOFFSET := 0
 VAROFFSET := 0
```

Table 5-384 Parameters for the FC86 function

| Parameter | Value | Description |
|---|---|---|
| PIN | 10 | Offset within the INTERBUS input data (start address of the operating device's input data)<br>(Example: 10 = E10) |
| POUT | 10 | Offset within the INTERBUS output data (start address of the operating device's output data)<br>(Example: 10 = PAB10) |
| IBDB | DB20 | INTERBUS data block<br>(Example: DB20) |
| DEST | DB10.DBX0.0 | Destination address of the operating device's data in the controller<br>(Example: DB10.DBX0.0) |
| SOURCE | DB10.DBX10.0 | Source address of the operating device's data in the controller<br>(Example: DB10.DBX10.0) |
| DBOFFSET | 0 | DB offset which is added to the data block address of the variables<br>(Example: 0) |
| VAROFFSET | 0 | Variable offset which is added to the byte address of the variables<br>(Example: 0) |

#### 5.22.7.1.17 FC65 for the Operating Mode 'Asynchronous with Synchronization Impulse' with S7-300

This function decodes the data transferred by the operating device, and executes read and write accesses accordingly. The data width is 8 bytes. Accesses are made to the data sets which were parameterized in IBS CMD.

DBOFFSET and VAROFFSET also permit access to data blocks and byte addresses greater than 255.

**Parameter:**

```
Call FC 65 PIN := EB10 POUT := AB10 DBOFFSET := 0 VAROFFSET := 0
```

Table 5-385 Parameters for the FC65 function

| Parameter | Value | Description |
|---|---|---|
| PIN | EB10 | Start address of the operating device's inputs<br>(Example: EB10) |
| POUT | AB10 | Start address of the operating device's outputs<br>(Example: AB10) |
| DBOFFSET | 0 | DB offset which is added to the data block address of the variables<br>(Example: 0) |
| VAROFFSET | 0 | Variable offset which is added to the byte address of the variables<br>(Example: 0) |

#### 5.22.7.1.18 FC85 for the Operating Mode 'Asynchronous with Synchronization Impulse' with S7-300

This function decodes the data transferred by the operating device, and executes read and write accesses accordingly. The data width is 10 bytes. Accesses are made to the data sets which were parameterized in IBS CMD.

DBOFFSET and VAROFFSET also permit access to data blocks and byte addresses greater than 255.

**Parameter:**

```
Call FC 85 PIN := EB10 POUT := AB10 DBOFFSET := 0 VAROFFSET := 0
```

Table 5-386 Parameters for the FC85 function

| Parameter | Value | Description |
|---|---|---|
| PIN | EB10 | Start address of the operating device's inputs<br>(Example: EB10) |
| POUT | AB10 | Start address of the operating device's outputs<br>(Example: AB10) |
| DBOFFSET | 0 | DB offset which is added to the data block address of the variables<br>(Example: 0) |
| VAROFFSET | 0 | Variable offset which is added to the byte address of the variables<br>(Example: 0) |

#### 5.22.7.1.19 Example for the Operating Mode 'Asynchronous'

OB1 and OB100 for S7-300

When calling up the function FC20 (INIT_IB) in OB100, you must set the MODE parameter to zero (0).

**OB1**

```
...
Call FC 66
 PIN 10
 POUT 10
 IBDB DB20
 DEST DB10.DBX0.0
 SOURCE DB10.DBX8.0
 DBOFFSET 0
 VAROFFSET 0
...
BE
```

**OB100**

```
UN M 10.0
S M 10.0
R M 10.1
CALL FC 20
 IBDB := DB20
 COM_ADR := 256
 DIAG_STATE := 0
 DIAG_PARA := 0
 FKN_START := 0
 FKN_PARA := 0
 FKN_STATE := 0
 MEM_READ := 21
 MEM_WRITE := 22
 LOAD := 0
 BOOT := 0
 MODE := 0
```

```
 TIMER_NR := T1
 SOURCE := 0
 CONFIGURATION := DW#16#8000000F
 RET := M10.1
 BUSY := M10.0
UN M 100.7
S M 100.7
UN M 10.0
UN M 10.1
BE
```

OB1 for S7-400

**OB1**

```
...
Call FC 60
 PIN P#P10.0
 DEST P#DB101.DBX0.0 Byte 8
 SOURCE P#DB101.DBX8.0 Byte 8
 POUT P#P10.0
 DBOFFSET 0
 VAROFFSET 0
...
```

#### 5.22.7.1.20 Example for the Operating Mode 'Asynchronous with Synchronization Impulse'

OB1, OB40, OB100, FC50 and FC51 for S7-300

**OB1**

```
...
CALL FC 28
   IBDB         :=  DB20
   READ_FC      :=  FC50
   WRITE_FC     :=  FC51
   CYCLE_OB     :=  TRUE
   RET          :=  M14.0
...
BE
```

**OB40**

```
CALL FC 28
   IBDB         :=  DB20
   READ_FC      :=  FC50
   WRITE_FC     :=  FC51
   CYCLE_OB     :=  FALSE
   RET          :=  M12.0
BE
```

**OB100**

```
UN M          10.0
S  M          10.0
R  M          10.1
CALL FC 20
   IBDB         :=  DB20
   COM_ADR      :=  256
   DIAG_STATE   :=  0
   DIAG_PARA    :=  0
   FKN_START    :=  0
   FKN_PARA     :=  0
   FKN_STATE    :=  0
   MEM_READ     :=  21
   MEM_WRITE    :=  22
   LOAD         :=  0
   BOOT         :=  0
   MODE         :=  2
   TIMER_NR     :=  T1
   SOURCE       :=  0
```

```
   CONFIGURATION:=  DW#16#8000000F
   RET           :=  M10.1
   BUSY          :=  M10.0
UN M           10.0
UN M           10.1
BE
```

**FC50**

```
UN M           10.0
S  M           10.0
CALL FC 21
   IBDB          :=  DB20
   MODE          :=  1
   SOURCE        :=  0
   DEST_AREA     :=  0
   DEST_AREA_NR  :=  0
   DEST_OFFSET   :=  0
   DEST_LENGTH   :=  0
   RET           :=  M10.1
   BUSY          :=  M10.0
CALL FC 65
   PIN           :=  EB10
   POUT          :=  AB10
   DBOFFSET      :=  0
   VAROFFSET     :=  0
BE
```

**FC51**

```
UN M           11.0
S  M           11.0
CALL FC 22
IBDB             :=  DB20
MODE             :=  1
SOURCE_AREA      :=  0
SOURCE_AREA_NR   :=  0
SOURCE_OFFSET    :=  0
SOURCE_LENGTH    :=  0
DESTINATION      :=  0
RET              :=  M11.1
BUSY             :=  M11.0
BE
```

## 5.23 Modbus TCP

The Modbus TCP protocol can be used for communication between one operating device (acting as a client) with up to 16 controllers (acting a server). The controllers in turn can be connected with slaves or other servers. In this way, the operating device is capable of exchanging data with the various servers - which do not necessarily have to be directly connected with each other.

You use a host name table to manage the connections between the operating device and the server. In this host name table, you assign a host address to each connection number. The connection number you enter into the variable list for each variable.

Table 5-387 Client/server/slave connections

| Operating device | Communication | Server Controller (1 to 16) | Communication | Slave Controller (1 to 247) |
|---|---|---|---|---|
| Client | ⟷ | Server 1 | | |
| | ⟷ | Server 2 | | |
| | ⟷ | Server 3 | | |
| | ⟷ | Server 4 | | |
| | ⟷ | Server 5 (configured as a "bridge“) | ⟷ | Slave 1 |
| | | | ⟷ | Slave 2 |
| | | | ⟷ | Slave 3 |

## 5.23.1 Programming

### 5.23.1.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.23.1.1.1 Controllers

This parameter specifies the function codes used to address the controller.

Table 5-388 Controller

| Configurable Values | Default Value |
|---|---|
| Address is decremented by 1; F-Codes 1, 2, 3, 4, 5, 6, 15, 16 | X |
| Address remains unchanged; F-Codes 1, 2, 3, 4, 5, 6 | |
| Address remains unchanged; F-Codes 1, 2, 3, 4, 5, 6, 15, 16 | |
| Address remains unchanged; F-Codes 1, 2, 3, 4, 15, 16 | |

#### 5.23.1.1.2 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-389 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 100 ms to 25500 ms | 1000 ms |

#### 5.23.1.1.3 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-390 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1000 ms to 25000 ms | 5000 ms |

#### 5.23.1.1.4 Word Swap in Double-Word

This parameter specifies whether the words of a double-word are to be swapped.

Table 5-391 Word swap in double-word

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.23.1.1.5 Use host name table from file

This parameter specifies whether the host name table is to be imported from a symbol file.

The symbol file should have the extension .SYM. ASCII or UNICODE characters can be used to create this file.

Table 5-392 Use host name table from file

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.23.1.1.6 Host Name Table

In the host name table, enter up to 16 IP addresses of the controllers with which the operating device communicates. The connection number corresponds to the client/server connection which you specify in the variable list.

The host names can be up to 32 characters long. Duplicate entries are not permitted in the host name table.

Table 5-393 Host name table

| Connection Number | Host Name |
|---|---|
| 1 | www.hostname1.de |
| 2 | |
| 3 | www.hostname2.de |
| 4 | |
| 5 | www.hostname3.de |
| 6 | |
| 7 | |
| 8 | |
| 9 | |
| 10 | |
| 11 | 192.168.0.12 |
| 12 | |
| 13 | |
| 14 | |
| 15 | |
| 16 | |

### 5.23.1.2 Variable List

In the variable list of the programming software, you enter the variables according to the following principle. This example uses the entries in the host name table described in the protocol parameter section.

The default value for the slave number is 255.

Table 5-394 Variable list, Modbus TCP

| No. | Variable Name | Variable Address | Server No. (1 to 16) | Slave No. (1 to 247) | Low Bit No. | High Bit No. |
|---|---|---|---|---|---|---|
| 1 | DW 100,4-19 | D3100 | 5 | 2 | 4 | 19 |
| 2 | W200 | W4200 | 11 | 255 | | |
| 3 | Daten_sv_3 | W440 | 11 | 255 | | |
| 4 | Daten_sl_1 | W440 | 5 | 1 | | |

#### 5.23.1.3 System Parameters

##### 5.23.1.3.1 Poll Area

The poll area is used to manage the write coordination byte (WCB), the serial message channel and the LEDs in the function keys. This area is continuously polled by the operating device.

Define this area as a word area.

Table 5-395 Poll area for Modbus TCP

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address +0 | 400010 | Write Coordination Byte | Reserved |
| Word Address +1 | 400011 | Serial Message Channel<br>High Byte | Serial Message Channel<br>Low Byte |
| Word Address +2 | 400012 | LED 1 to 4 | LED 5 to 8 |
| Word Address +3 | 400013 | LED 9 to 12 | LED 13 to 16 |
| Word Address +4 | 400014 | LED 17 to 20 | LED 21 to 24 |
| Word Address +5 | 400015 | LED 25 to 28 | LED 29 to 32 |

### 5.23.2 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-396 Error messages for Modbus TCP

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | 10 | No cyclic data defined | |
| 2 | 60 | Waiting time for response elapsed | |
| | 61 | Address can not be decremented | Address = 0 |
| | 68 | Incorrect number of data received | Check if the mask, in which the error occurred, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| 3 | | Modbus TCP error messages from server | |
| | 1 | Wrong function code | |
| | 2 | Wrong address | |
| | 3 | Wrong data value | |
| | 4 | General abort | |
| | 5 | Waiting time elapsed | |
| | 8 | Address is write-protected | |
| 7 | | No connection in TCP | |
| | xx | Server number | |
| 8 | | Incorrect send job in TCP | |
| | xx | Server number | |
| 9 | | Incorrect receive job in TCP | |
| | xx | Server number | |

## 5.24 OMRON Host-Link

TesiMod operating devices can be easily connected to all controllers that support the OMRON Host-Link protocol. The OMRON Host-Link protocol allows communication between one operating device and up to 32 controllers.

### 5.24.1 Telegram Mode

With this protocol, the TesiMod operating device has client functionality and every data transfer is initiated by the operating device.

#### 5.24.1.1 Point-to-Point Connection

Only one operating device can be connected to the controller. The same telegram mode must be specified on both sides.

Most OMRON controllers exclusively use the Multiple Mode and are not adjustable. In this case, specify the corresponding setting for the operating device.

#### 5.24.1.2 Multipoint Connection

With one TesiMod operating device, you can address up to 32 controllers.

For a multipoint connection you need a NT-AL001 module that connects the operating device to the RS422 bus.

If you connect the TesiMod operating device directly to the RS422 bus, you will need to add the required terminating resistors.

### 5.24.2 Data Types

Direct access is possible to the following data types.

The address areas are controller-specific.

Table 5-397 OMRON Host-Link data types

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| IR | 0.0 to 2555.15 | Bit | |
| IR | 0 to 2555 | Word | |
| IRd | 30 to 2554 | Double Word | |
| LR | 0.0 to 63.15 | Bit | |
| LR | 0 to 63 | Word | |
| LRd | 0 to 62 | Double Word | |
| HR | 0.0 to 99.15 | Bit | |
| HR | 0 to 99 | Word | |
| HRd | 0 to 98 | Double Word | |
| AR | 0.0 to 511.15 | Bit | |
| AR | 0 to 511 | Word | |

Table 5-397 OMRON Host-Link data types

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| ARd | 0 to 510 | Double Word | |
| DM | 0 to 9999 | Word | |
| DMd | 0 to 9998 | Double Word | |
| TC | 0 to 1023 | Word | Read-only |

## 5.24.3 Programming

### 5.24.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.24.3.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-398 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.24.3.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-399 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.24.3.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-400 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.24.3.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-401 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | X |
| 8 | |

#### 5.24.3.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-402 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.24.3.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-403 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 500 ms |

#### 5.24.3.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-404 Delay until Connection Set-Up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.24.3.1.8 Mode

This parameter specifies whether you intend to connect the operating device to one (Single) or more (Multiple) controllers.

Table 5-405 Mode

| Configurable Values | Default Value |
|---|---|
| Multiple | X |
| Single | |

#### 5.24.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

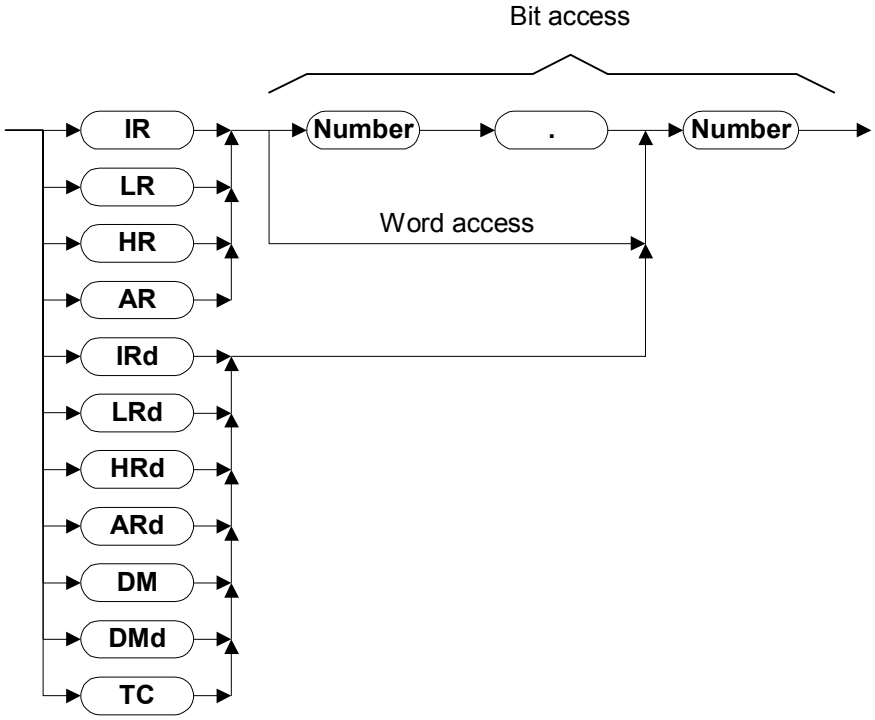



Figure 5-57 Syntax diagram

#### 5.24.3.3 System Parameters

##### 5.24.3.3.1 Poll Area

For the address of the poll area, you must specify an address of the data memory area.

Table 5-406 Word-oriented poll area - OMRON NT-Link

| Word Address | Refe-rence | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | DM100 | Write Coordination Byte | Reserved |
| Word Address + 1 | DM101 | Message Channel High-Byte | Message Channel Low-Byte |
| Word Address + 2 | DM102 | Function Key LEDs 1 to 4 | Function Key LEDs 5 to 8 |
| Word Address + 3 | DM103 | Function Key LEDs 9 to 12 | Function Key LEDs 13 to 16 |
| Word Address + 4 | DM104 | Function Key LEDs 17 to 20 | Function Key LEDs 21 to 24 |
| Word Address + 5 | DM105 | Function Key LEDs 25 to 28 | Function Key LEDs 29 to 32 |

#### 5.24.3.3.2 Status Messages

For the address of the parallel message system, you must specify an address of the data memory area.

Table 5-407 Parallel message system

| Word Address | Refe-rence | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | DM100 | Messages 9 to 15 | Messages 0 to 8 |
| Word Address + 1 | DM101 | Messages 24 to 31 | Messages 16 to 23 |
| Word Address + 2 | DM102 | Messages 40 to 47 | Messages 32 to 39 |

### 5.24.4 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.24.4.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-408 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.24.4.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-409 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

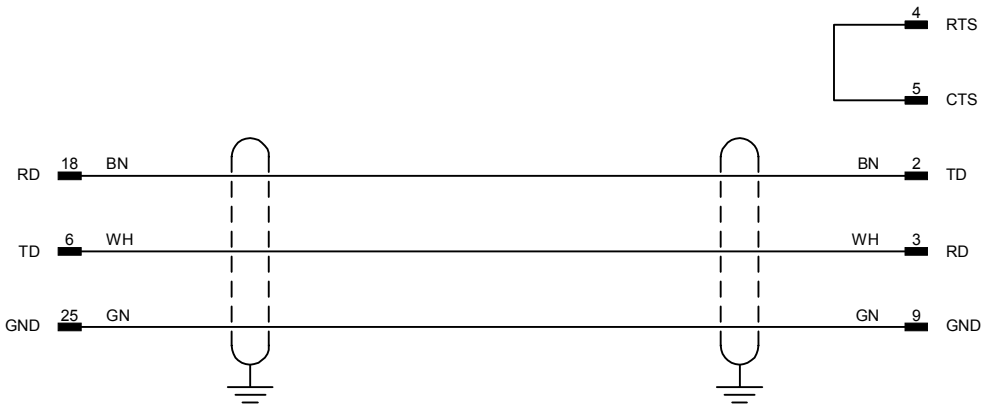
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.24.4.3 Cable X3 SER1 RS232 - OMRON Host-Link

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

OMRON PLC
RS232




D-SUB
male connector
25 pin

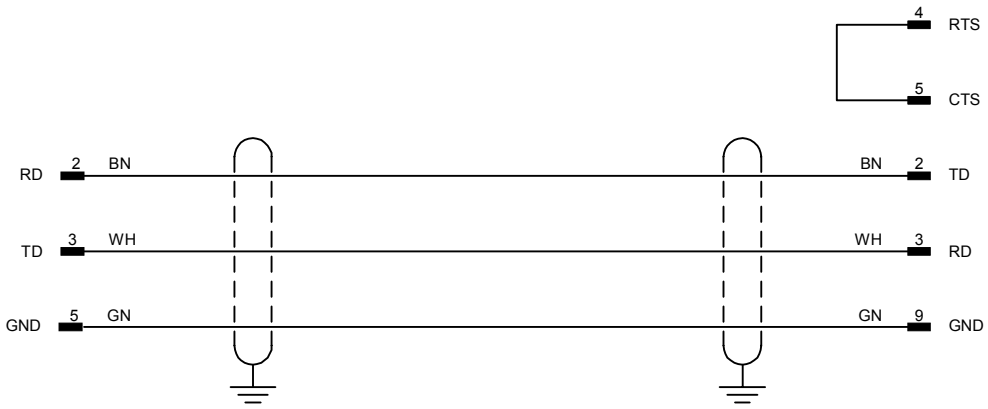
D-SUB
male connector
9 pin

#### 5.24.4.4 Cable X2 RS232 - OMRON Host-Link

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

OMRON PLC
RS232




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

### 5.24.5 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-410 OMRON Host-Link error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Communication error on hardware level | |
| 60 | | Communication error on protocol level | |
| | 10 | No response from controller | |
| | 20 | Incorrect number of data received | |
| | 30 | Wrong checksum | |
| 70 | | Undefined command | |
| 80 | | Error from controller | |
| | 01 | Can not be executed when controller is in RUN mode | |
| | 02 | Can not be executed when controller is in MONITOR mode | |
| | 19 | Frame checksum error | |
| | 20 | Command format error | |
| | 21 | Wrong read or write areas | |
| | 22 | Command not available | |
| | 24 | Frame length error | |
| | 35 | User memory is write-protected | |

## 5.25 OMRON NT-Link

TesiMod operating devices can be easily connected to all controllers that support the OMRON NT-Link protocol. The OMRON NT-Link protocol allows communication between one controller and up to 8 TesiMod operating devices.

In OMRON controllers, the Host-Link protocol is used by default. Therefore, you need to check the protocol setting before using the NT protocol. See the controller's operating instructions for more information.

### 5.25.1 Telegram Mode

The NT-Link protocol provides two different protocol types. Use the 1:1 protocol for point-to-point connections and use the 1:N protocol for multipoint connections.

#### 5.25.1.1 Point-to-Point Connection

Only one operating device can be connected to the controller. You can use the RS232 or the RS422 / RS485 interface for the connection. When using the RS422 / RS485 interface, a 4-wire cable must be used.

#### 5.25.1.2 Multipoint Connection

You can connect up to 8 operating devices to one controller.

Make sure to configure the controller to address at least two operating devices. The RS422 / RS485 interface must be used for this connection. A 2-wire cable must be used to ensure sufficient termination.

### 5.25.2 Data Types

Direct access is possible to the following data types.

Bit, word and double-word accesses are possible (read and write accesses).

The address areas are controller-specific.

Table 5-411 Data types for the C series

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| IR | 0.0 to 511.15 | Bit | |
| IR | 0 to 511 | Word | |
| IRd | 0 to 510 | Double Word | |
| LR | 0.0 to 63.15 | Bit | |
| LR | 0 to 63 | Word | |
| LRd | 0 to 62 | Double Word | |
| HR | 0.0 to 99.15 | Bit | |
| HR | 0 to 99 | Word | |
| HRd | 0 to 98 | Double Word | |
| AR | 0.0 to 27.15 | Bit | |
| AR | 0 to 27 | Word | |

Table 5-411 Data types for the C series

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| ARd | 0 to 26 | Double Word | |
| DM | 0.0 to 9999.15 | Bit | |
| DM | 0 to 9999 | Word | |
| DMd | 0 to 9998 | Double Word | |
| EM | 0.0 to 6143.15 | Bit | |
| EM | 0 to 6143 | Word | |
| EMd | 0 to 6142 | Double Word | |
| TC | 0 to 511 | Word | Read-only |

Table 5-412 Data types for the CV-series:

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| IR | 0.0 to 2555.15 | Bit | |
| IR | 0 to 2555 | Word | |
| IRd | 0 to 2554 | Double Word | |
| GR | 0.0 to 255.15 | Bit | |
| GR | 0 to 255 | Word | |
| GRd | 0 to 254 | Double Word | |
| AR | 0.0 to 511.15 | Bit | |
| AR | 0 to 511 | Word | |
| ARd | 0 to 510 | Double Word | |
| DM | 0 to 24575 | Word | |
| DMd | 0 to 24575 | Double Word | |
| EM | 0.0 to 6143.15 | Bit | |
| EM | 0 to 32765 | Word | |
| EMd | 0 to 32764 | Double Word | |
| TIM | 0 to 1023 | Word | Read-only |
| CNT | 0 to 1023 | Word | Read-only |

Table 5-413 Data types for the CS1-series

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| IR | 0.0 to 6143.15 | Bit | |
| IR | 0 to 6143 | Word | |
| IRd | 0 to 6142 | Double Word | |
| AR | 0 to 447.15 | Bit | Read-only |
| | 448.0 to 959.15 | | |

Table 5-413 Data types for the CS1-series

| Mnemonic | Area | Address Width | Access |
|---|---|---|---|
| AR | 0 to 447 | Word | Read-only |
| | 448 to 959 | | |
| ARd | 0 to 446 | Double Word | Read-only |
| | 448 to 958 | | |
| HR | 0.0 to 511.15 | Bit | |
| HR | 0 to 511 | Word | |
| HRd | 0 to 510 | Double Word | |
| DM | 0 to 32767 | Word | |
| DMd | 0 to 32766 | Double Word | |
| EM00 to EM12 | 0 to 32767 | Word | |
| EMd00 to EMd12 | 0 to 32766 | Double Word | |
| TIM | 0 to 4095 | Word | Read-only |
| CNT | 0 to 4095 | Word | Read-only |

## 5.25.3 Programming

### 5.25.3.1 Protocol Parameters

#### 5.25.3.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-414 Baud rate

| Configurable values (Baud) | Default Value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | |
| 19200 | X (1:1) |
| 38400 | X (1:N) |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.25.3.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-415 Parity

| Configurable values | Default Value |
|---|---|
| None | |
| Even | |
| Odd | X |

#### 5.25.3.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-416 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.25.3.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-417 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.25.3.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-418 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.25.3.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-419 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 500 ms |

#### 5.25.3.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-420 Delay until Connection Set-Up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.25.3.1.8 NT Module Number

Use this parameter to set the NT module number for the operating device. When multiple operating devices are connected to one controller, specify a different number for each operating device.

Table 5-421 NT module number

| Configurable Values | Default Value |
|---|---|
| 0 to 7 | 0 |

To set the NT module number via the operating device, use the system variable **ComSlaveNr**.

#### 5.25.3.1.9 Protocol Mode

For the protocol mode, specify whether you are using a point-to-point connection (1:1) or a multipoint connection (1:N). Ensure that this parameter matches the setting specified for the controller.

Table 5-422 Protocol Mode

| Configurable Values | Default Value |
|---|---|
| 1:1 | |
| 1:N | X |

#### 5.25.3.1.10 Priority

This parameter applies only in conjunction with the 1:N protocol.

If the priority is deactivated, the master successively passes the token to each station. Activate the parameter Priority if you want the master to pass every second token to the operating device.

Table 5-423 Priority

| Configurable Values | Default Value |
|---|---|
| None | X |
| Terminal gets every second token | |

#### 5.25.3.1.11 Duplex Operation

Select this parameter when using an RS232 interface.

The parameter Half Duplex applies only in conjunction with the RS422 / RS485 interface.

Table 5-424 Duplex Operation

| Configurable Values | Default Value |
|---|---|
| Full duplex - RS232 | X |
| Half duplex - RS422/ 485 | |

#### 5.25.3.1.12 PLC Type

This parameter specifies which controller is used.

Table 5-425 PLC type

| Configurable Values | Default Value |
|---|---|
| C series | X |
| CV series | |
| CS1 series | |

#### 5.25.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

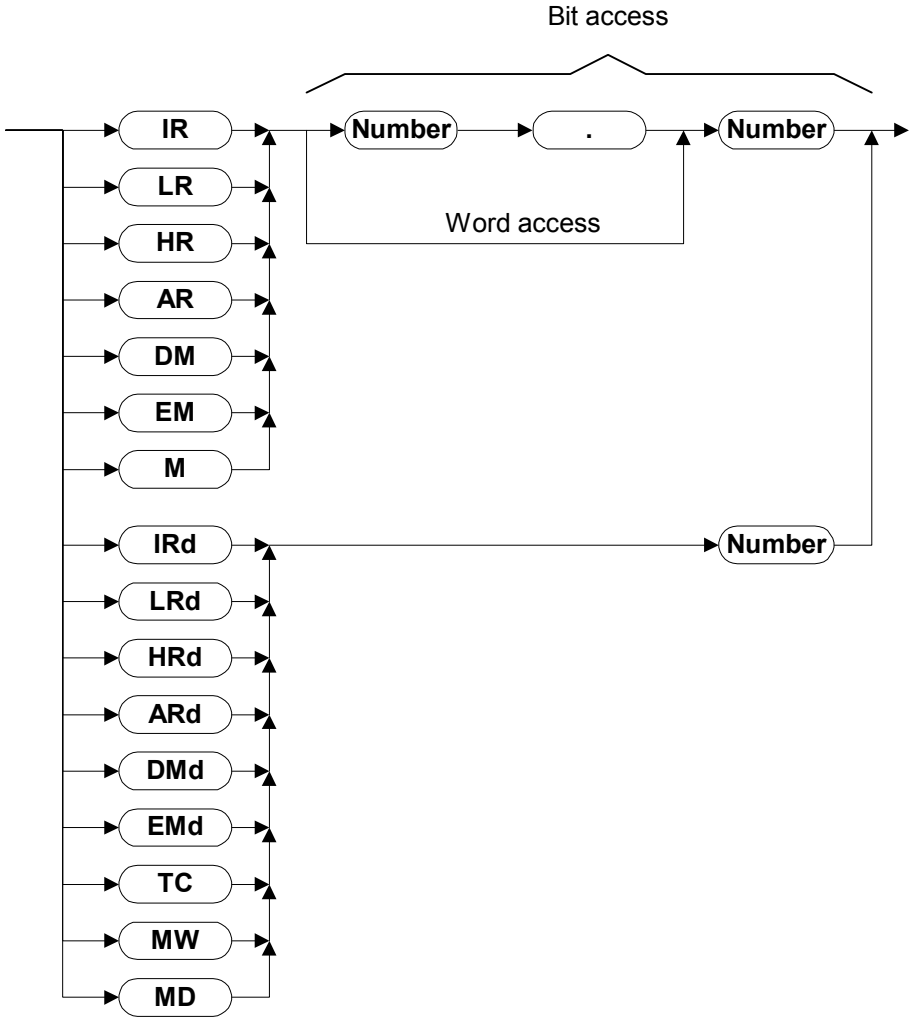



Figure 5-58 Syntax diagram OMRON NT-Link C series

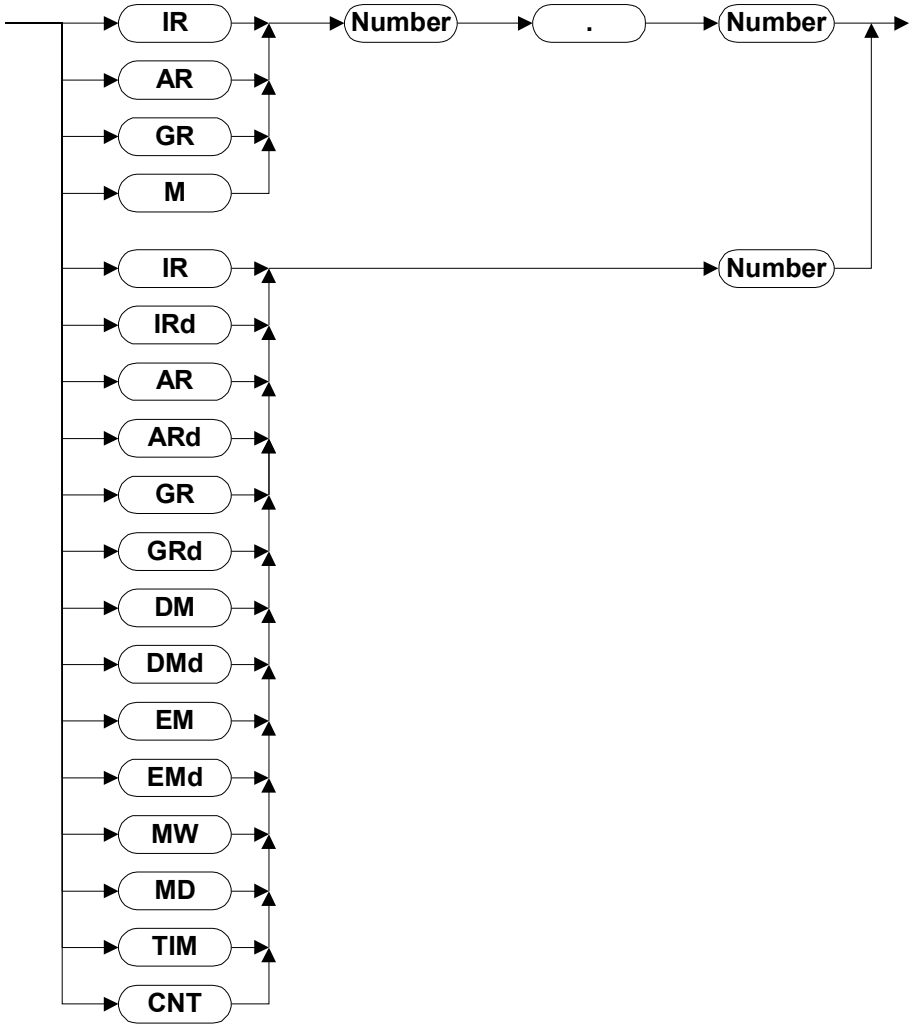



Figure 5-59 Syntax diagram OMRON NT-Link CV series

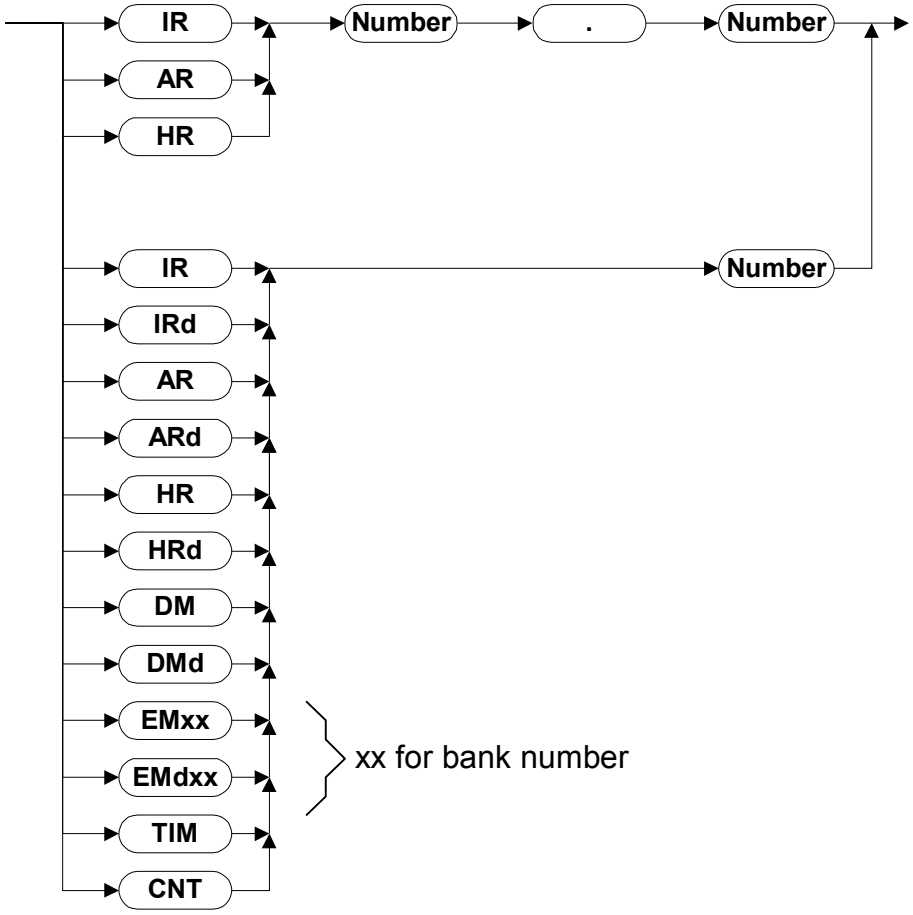



Figure 5-60 Syntax diagram OMRON NT-Link CS1 series

#### 5.25.3.3 System Parameters

##### 5.25.3.3.1 Poll Area

The poll area must reside in the data memory area and must be addressed as a data memory word (DM).

Table 5-426 Word-oriented poll area - OMRON NT-Link

| Word Address | Refe-rence | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | DM100 | Write Coordination Byte | Reserved |
| Word Address + 1 | DM101 | Message Channel High-Byte | Message Channel Low-Byte |
| Word Address + 2 | DM102 | Function Key LEDs 1 to 4 | Function Key LEDs 5 to 8 |
| Word Address + 3 | DM103 | Function Key LEDs 9 to 12 | Function Key LEDs 13 to 16 |
| Word Address + 4 | DM104 | Function Key LEDs 17 to 20 | Function Key LEDs 21 to 24 |
| Word Address + 5 | DM105 | Function Key LEDs 25 to 28 | Function Key LEDs 29 to 32 |

#### 5.25.3.3.2 Status Messages

The parallel message system must reside in the data memory area and be addressed as a data memory word (DM).

Table 5-427 Parallel message system

| Word Address | Refe-rence | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | DM100 | Messages 9 to 15 | Messages 0 to 8 |
| Word Address + 1 | DM101 | Messages 24 to 31 | Messages 16 to 23 |
| Word Address + 2 | DM102 | Messages 40 to 47 | Messages 32 to 39 |

## 5.25.4 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.25.4.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-428 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

Table 5-429 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.25.4.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-430 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

Table 5-431 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

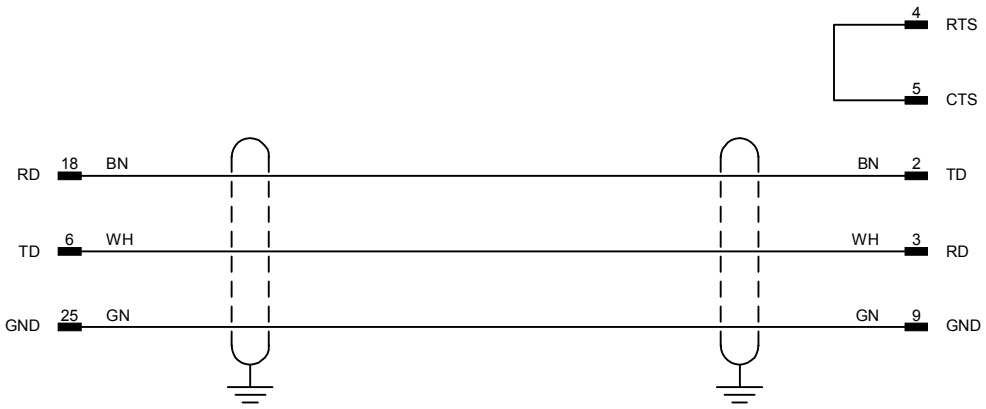
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.25.4.3 Cable X3 SER1 RS232 - OMRON NT-Link

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

OMRON PLC
RS232




D-SUB
male connector
25 pin

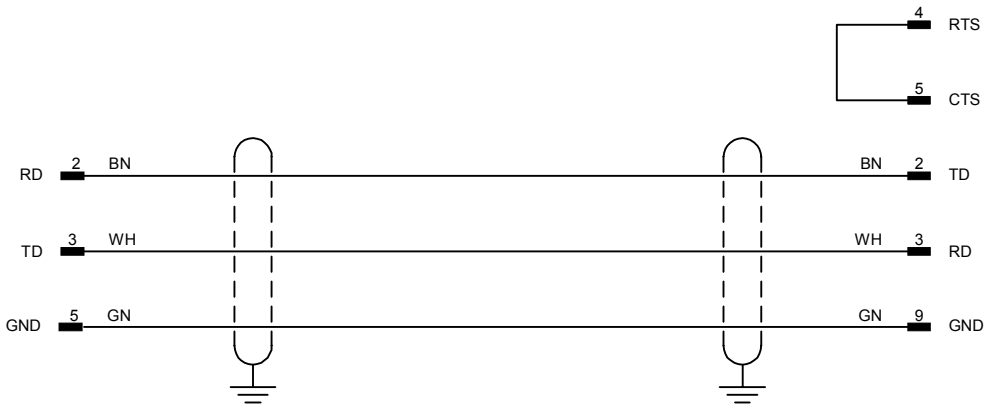
D-SUB
male connector
9 pin

#### 5.25.4.4 Cable X2 RS232 - OMRON NT-Link

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

OMRON PLC
RS232




D-SUB
male connector
9 pin

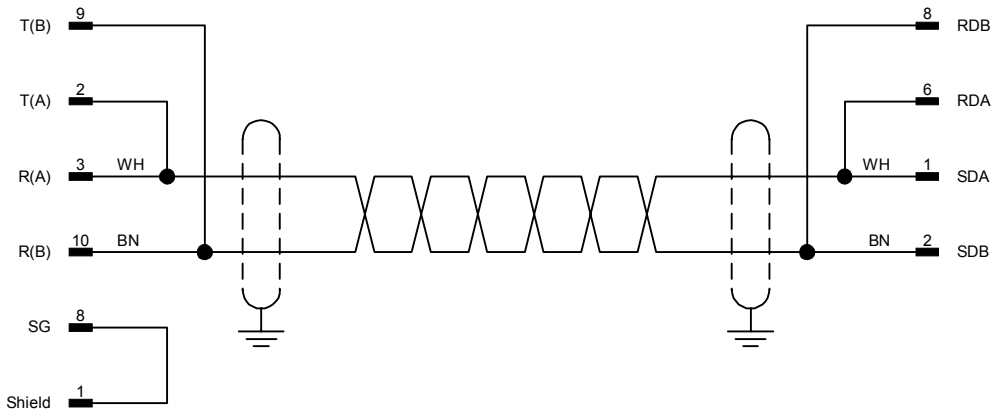
D-SUB
male connector
9 pin

#### 5.25.4.5 Cable X3 SER1 RS485 - OMRON NT-Link 2-Wire

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

OMRON PLC
RS422/485




D-SUB
male connector
25 pin

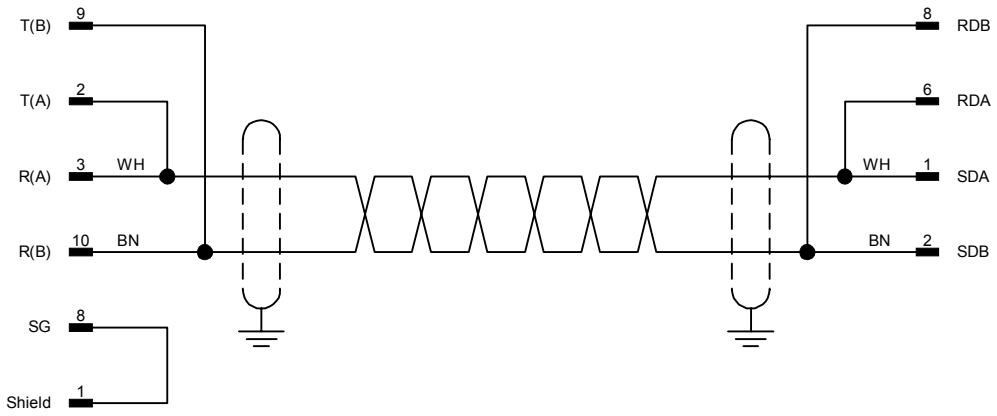
D-SUB
male connector
9 pin

#### 5.25.4.6 Cable X2 RS485 - OMRON NT-Link 2-Wire

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

OMRON PLC
RS422/485




D-SUB
male connector
15 pin

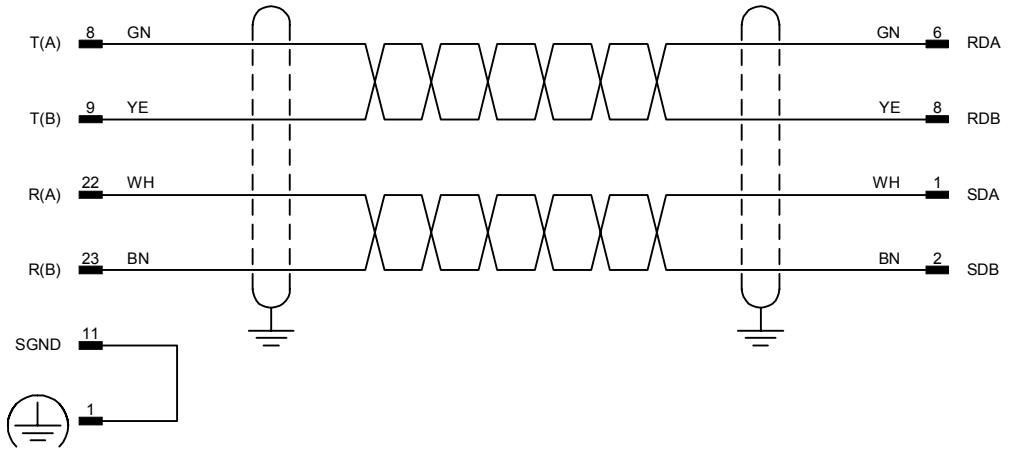
D-SUB
male connector
9 pin

#### 5.25.4.7 Cable X3 SER1 RS485 - OMRON NT-Link 4-Wire

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

OMRON PLC
RS422/485




D-SUB
male connector
25 pin

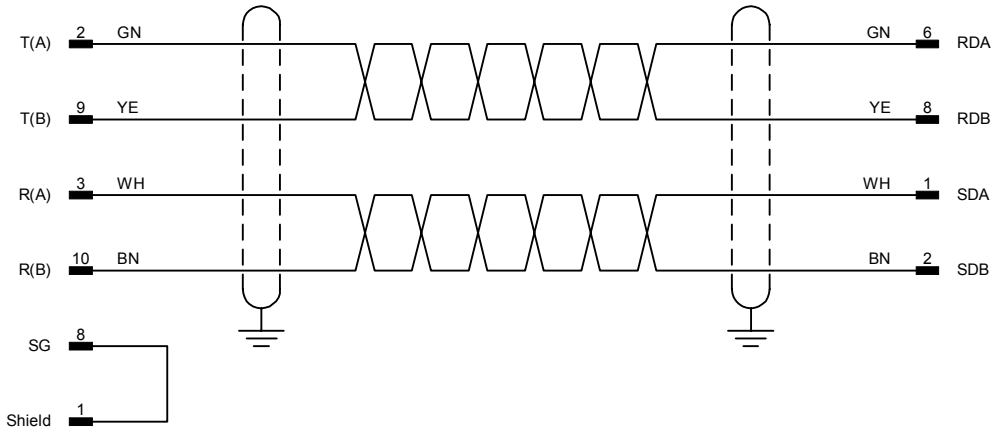
D-SUB
male connector
9 pin

#### 5.25.4.8 Cable X2 RS485 - OMRON NT-Link 4-Wire

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

OMRON PLC
RS422/485




D-SUB
male connector
15 pin

D-SUB
male connector
9 pin

### 5.25.5 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-432 OMRON NT-Link error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Communication error on hardware level | |
| | 3 | Protocol framing error | |
| | 6 | Parity error | |
| | 10 | Poll area not defined | |
| | 16 | Receive buffer overrun | |
| | 40 | Access to unknown system address | |
| 60 | | Communication error on protocol level | |
| | 10 | No response from controller | |
| | 20 | Terminal setting = 1:1,controller setting = 1:N | |
| | 30 | Wrong checksum | |
| 70 | | Undefined command | |
| 80 | | Error from controller | |
| | 00 | Error in checksum | |
| | 01 | Undefined command | |
| | 03 | Error in format | |
| | 05 | Error in parameter | Wrong address specified |
| | 07 | Status error | |

## 5.26 Phoenix SSGI

The CP series devices from Phoenix Contact incorporate a TesiMod operating unit and INTERBUS master controller unit. The devices use the Phoenix SSGI protocol to communicate between these two units.

You can create the application description for the TesiMod operating unit using TS-win as of Version 2.10. This allows you to select the devices from the CP series.

The TesiMod operating unit offers all of the TesiMod series capability, except for the table function.

You can program the controller unit in the usual way using PC-WORX.

### 5.26.1 Transfer of Process Variables

To ensure that the process variables are properly transferred, you must create the application description for the TesiMod operating unit in the same directory as the PC-WORX project.

PC-WORX creates the file SR.CSV. This file contains a list of all process variables that the TesiMod operating unit can access.

The PC-WORX project directory contains the file CSV.LST, which in turn contains the directory details for the file SR.CSV. These details are used by the programming software to find the file SR.CSV.

The programming software imports the list for the file SR.CSV and provides the variables for the application description contained in the list.

If you use an older version of the file SR.CSV in the programming software and then load the application created with this file onto the device, the TesiMod operating unit does not access the process variables in the controller unit. Instead, it displays the value “0“. It then also displays a system message stating that a new application is required.

The changed data in the file SR.CSV is taken into account when a new compilation run takes place in the programming software. You must then reload the application into the TesiMod operating unit.

For more information, see the Phoenix Contact user manual “Quick Start TSwin“.

## 5.26.2 Programming

### 5.26.2.1 Protocol Parameters

#### 5.26.2.1.1 Maximum Waiting Time For Response

This parameter specifies how long the operating unit will wait for a reply from the controller unit.

Table 5-433 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 1000 ms |

#### 5.26.2.1.2 Delay until Connection Set-Up

This parameter specifies a particular waiting period after which the operating unit starts the communication process.

Table 5-434 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1 s to 25 s | 10 s |

### 5.26.2.2 System Parameters

#### 5.26.2.2.1 Poll Area

The poll area consists of three single variables.

Table 5-435 Poll area, with three single variables

| Variable for subarea | Length |
|---|---|
| Write Coordination Byte (WCB) | 1 Byte/1 Word |
| Message Number | 1 Word |
| Status LEDs for Function Keys | 5 Bytes<br>ARRAY OF BYTE[1..5] |

#### 5.26.2.2.2 Status Messages

Status messages represent the static assignment of flags (bits) in the controller unit to plain text messages in the operating unit of the device.

For the parallel message system, define an ARRAY OF BYTE type variable with a maximum length of 50 bytes.

#### 5.26.2.2.3 Data Set Transfer

A recipe buffer is not used during the data set transfer of recipes. You must write the data set values directly to the single variables.

#### 5.26.2.3 Variables

The operating devices in the CP series can handle up to 1000 variables.

##### 5.26.2.3.1 Variable Types

You can use the byte, word and double-word type variables directly.

For longer variables, you must use the ARRAY OF BYTE type variables. In PC-WORX, you must create and use an appropriate data type for this purpose, and make sure that this type has the same number of elements and the same number of bytes (length specification) programmed in TSwin.

Use the ARRAY OF BYTE type for the following objects:

Table 5-436 Objects for ARRAY OF BYTE

| Object | Number of Elements is Equal to |
|---|---|
| Text Variable | String Length |
| Parallel Message System | Number of Bytes |
| Status LEDs for Function Keys | Number of Bytes |

The maximum size of data objects is 50 bytes.

#### 5.26.2.4 Control Command Byte in DPRAM

Using the control command byte in DPRAM, you can start a number of functions in the controller unit of the device.

The control command byte has the permanent address **0x7C7**.

Table 5-437 Control command byte

| Bit | Command | Description |
|---|---|---|
| 0 | Stop | The bits are set by the operating unit and then reset by the controller unit once the action is successfully completed. |
| 1 | Cold Start | |
| 2 | Warm Start | |
| 3 | Hot Start | |
| 4 | INTERBUS initialized | This bit is set by the controller unit after the INTERBUS has been initialized. The operating unit can then access the DPRAM. |
| 5 | Reserved | |
| 6 | | |
| 7 | | |

#### 5.26.2.5 Date and Time Addresses in DPRAM

The addresses **0x7C8 to 0x7CF** are reserved in DPRAM for transferring the date and time. The year is transferred as a two-digit number by default. In the programming software, choose the selection field **year with 4-digits** to transfer the full details of the year.

Table 5-438 Image of date and time with a 2-digit year

| Address | | | Content |
|---|---|---|---|
| Address + 0 | Y | Y | Year (00 to 99) |
| Address + 1 | M | M | Month (01 to 12) |
| Address + 2 | D | D | Day (01 to 31) |
| Address + 3 | h | h | Hour (00 to 23) |
| Address + 4 | m | m | Minute (00 to 59) |
| Address + 5 | s | s | Seconds (00 to 59) |
| Address + 6 | W | W | Weekday (0 to 6 or 1 to 7) |

Table 5-439 Image of date and time with a 4-digit year

| Address | | | Content |
|---|---|---|---|
| Address + 0 | H | H | Century (00 to 99) |
| Address + 1 | Y | Y | Year (00 to 99) |
| Address + 2 | M | M | Month (01 to 12) |
| Address + 3 | D | D | Day (01 to 31) |
| Address + 4 | h | h | Hour (00 to 23) |
| Address + 5 | m | m | Minute (00 to 59) |
| Address + 6 | s | s | Seconds (00 to 59) |
| Address + 7 | W | W | Weekday (0 to 6 or 1 to 7) |

#### 5.26.2.6 Other Addresses in DPRAM

All other addresses in DPRAM are contained in the variable list in the programming software. However, the only entries transferred from PC WORX are those for which the selection fields **PPD** and **CSV** have been selected.

### 5.26.3 Physical Interfacing

The operating unit and controller unit are physically connected by means of an internal connector. Data is exchanged between the two units via a DPRAM.

### 5.26.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-440 Phoenix SSGI error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | 01 | The memory can not be accessed. | |
| 60 | 01 | The waiting time has elapsed and there is no release signal from the controller unit (master). | |
| | 02 | The result bit is not set (SSGI interface) | |
| 70 | 02 | The waiting time has elapsed and the SSGI sending box is not free. | |
| | 03 | The waiting period has elapsed and the SSGI status bit is not set. | |
| | 04 | The waiting period has elapsed and the SSGI status bit is not deleted. | |
| | 06 | The waiting period has elapsed and the SSGI notification bit is not deleted (no response from controller unit). | |
| | 07 | The waiting period has elapsed and the SSGI notification bit is not deleted. | |
| 80 | xx | An error has occurred in reading/writing the process variables.<br>The subcode contains the error code from the controller unit (master). | |
| 90 | xx | An error has occurred in reading/writing the IBS system variables.<br>The subcode contains the error code from the controller unit (master). | |
| 100 | 01 | The response to a read request does not contain any data. | |
| | 02 | The length of the received data is not the same as the length of the requested data. | |

# 5.27 ProComm plus

## 5.27.1 Hardware

Use the programming cable from the Schleicher company to connect TesiMod operating devices to the programming interface of the PLC.

## 5.27.2 Software

The "Schleicher ProComm plus" protocol allows access to data objects in the PLC. The programming software "Prodoc Plus" saves the data objects into a file. TSwin reads the global variables from this file and places them into the variable list to make them available for further use. The variable list can not be changed.

## 5.27.3 Data Types

The length of a variable is determined by the length defined in the programming software Prodoc Plus. The data types Timer and Counter are not supported.

### 5.27.3.1 Single Variables

You can access byte, word and double-word type variables. Floating point numbers are interpreted in IEEE format. The variable type REAL is required for this purpose.

### 5.27.3.2 String Variables

For string variables, use the variable type ARRAY [0..X] OF BYTE (where X stands for the length of the string).

## 5.27.4 Programming

### 5.27.4.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.27.4.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-441 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 9600 | |
| 19200 | |
| 38400 | X |

#### 5.27.4.1.2 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-442 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 100 ms to 25500 ms | 1000 ms |

#### 5.27.4.1.3 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-443 Delay until Connection Set-Up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.27.4.1.4 Path of the Variable List sr.csv

This parameter specifies the directory in which the variable list sr.csv is stored.

To select a directory, click the Browse button.

The variable list sr.csv is automatically created by the programming software Prodoc Plus.

### 5.27.4.2 System Parameters

#### 5.27.4.2.1 Poll Area

Define the poll area using three single variables.

For these variables, use the variable types as shown in the following table.

Table 5-444 Poll area

| Element of the Poll Area | Data Type |
|---|---|
| Write Coordination Byte | BYTE |
| Message Channel | WORD |
| Status LEDs for Function Keys | ARRAY [0..X] OF BYTE |

#### 5.27.4.2.2 Status Messages

Use the data type ARRAY [0..X] OF BYTE for the parallel message system.

With X, you specify the length of the message system. Note that one byte represents eight parallel messages.

#### 5.27.4.2.3 Date and Time

Use the data type ARRAY [0..X] OF BYTE to transfer the date and time information.

For X, use either the value 7 to display only the last two digits for the date (example: 01) or the value 8 to display all four digits (example: 2001).

#### 5.27.4.2.4 Tables

Tables can not be displayed.

## 5.27.5 Physical Interfacing

Plug-in connections on the operating device for connecting to controllers with various communication modules.

### 5.27.5.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-445 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.27.5.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-446 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

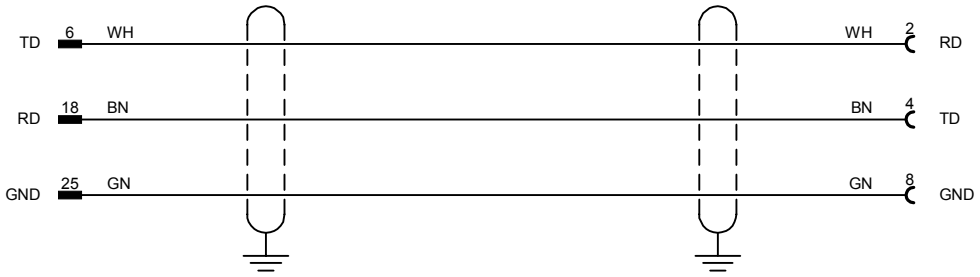
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.27.5.3 Cable X3 SER1 RS232 - Schleicher microLine

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Schleicher PLC
microLine




D-SUB
male connector
25 pin

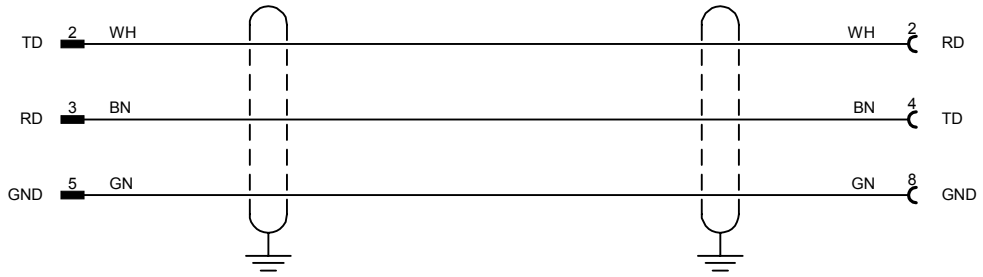
Latch-N-Lok
female connector
8 pin

#### 5.27.5.4 Cable X2 RS232 - Schleicher microLine

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Schleicher PLC microLine




D-SUB
male connector
9 pin

Latch-N-Lok
female connector
8 pin

### 5.27.6 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-447 ProComm plus error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Error on protocol level | |
| | 03 | Framing error on serial interface | |
| | 05 | CRC error on serial interface | |
| | 06 | Parity error on serial interface | |
| | 50 | Unable to assign memory | |
| 60 | | Error on hardware level | |
| | 01 | Timeout: No response from PLC | Cable break |
| | | | No connection to PLC |
| | | | Wrong baud rate |
| 70 | | Other errors | |
| | High Byte0x01 | ProConOs' protocol server is busy | |
| | High Byte 0x02 | Unknown request command | |
| | High Byte 0x40 | No access rights | |
| | High Byte 0x20 | Note the value in the low byteLow Byte 0x04 = No data available in PLC.Low Byte 0x08 = Too many data in PLC. | |

# 5.28 PROFIBUS-DP

Profibus DP provides a manufacturer- and controller-independent data transmission protocol. The Profibus DP is a speed-optimized Profibus variant that is specially tailored to communication between programmable controllers and decentralized peripheral devices.

Profibus DP is implemented in the operating device and meets the requirements of parts 1 and 3 of the German standard DIN 19245. It also corresponds to the European field bus standard EN 50170.

As the operating device fulfills standardization requirements, it can be successfully integrated as a slave into the Profibus DP.

All operating devices can be linked using an integrated Profibus DP additional module. You can also link several operating devices to one master controller.

The entire PROFIBUS DP protocol is handled by the protocol chip SPC3. Transfer speeds of up to 12 MBaud are possible.

The operating device is used in the bus as a decentralized module that occupies up to 256 inputs and outputs. The size can be programmed from between 8- and 32-byte IN data, and between 8- and 32-byte OUT data. Data transfer is carried out via the peripheral area.

The input/output image is exchanged cyclically between the master and operating device via the bus. In this context, the operating device uses the cyclical input/output image for data exchange between the master and the slave. The data content to be interpreted is defined for both partners in a data profile.

All services required for running the operating device originate in the operating device. The operating device has client functions.

The controller reacts to the requests of the operating device. It has server functions.

The master module must interpret the incoming data according to the profile and also respond according to the profile. This is carried out using a function block in the controller that is able to interpret the requests in the IN data, and write a response to the OUT data.

## 5.28.1 Specification for PROFIBUS-DP

The specification of the operating device in PROFIBUS DP is defined using the device data base (GSD) file SE03081A.GSD.

### 5.28.1.1 Diagnosis

The operating device implements the station-related diagnosis.

5-byte user diagnosis data is transferred

– 1st byte = error number (1 = communication error in the operating device)
– 2nd and 3rd byte communication error code
– 4th and 5th byte communication error subcode

The communication-error code and subcode are the values that are also displayed on the operating device.

## 5.28.2 Data Profile

To allow direct data access to the different data areas in a controller, a data profile must be agreed between the master and the slave.

The first four bytes of the telegram length set are used as follows:

– Telegram sequential number and length
– Definition of the access
– Definition of the data area

#### 5.28.2.1 Structure of the Data Profile

##### 5.28.2.1.1 Request Telegram

Table 5-448 Request telegram

| Byte | Content | |
|---|---|---|
| 1 | Number of user data, sequential number of telegram | |
| 2 | Access | |
| 3 | Offset (Depends on Byte Order Setting) | Low (High) |
| 4 | | High (Low) |
| 5 | User Data 1st Byte | |
| 6 | User Data 2nd Byte | |
| n | User Data nth Byte | |

**Byte 1** Number of User Data

Table 5-449 Number of User Data

| Bit | Content |
|---|---|
| 0 | Number of User Data in Byte.Specifies the number of bytes for the user data transfer. |
| 1 | |
| 2 | |
| 3 | |
| 4 | |
| 5 | Sequential Number of the Telegram.Identification number for each communication process.<br>(0 = initialization cycle, 1 - 7 = normal sequential number) |
| 6 | |
| 7 | |

**Byte 2** Access

Table 5-450 Access

| Bit | Content |
|---|---|
| 0 | Byte Number<br>For Word Access 0 = First Byte, 1 = Second Byte |
| 1 | Reserved |
| 2 | |
| 3 | |
| 4 | |
| 5 | Access:<br>00 = Bit<br>01 = Byte<br>02 = Word<br>03 = Double Word |
| 6 | |
| 7 | Data Direction:<br>0 = Read<br>1 = Write |

**Bytes 3 and 4** These bytes contain the address for accessing a data area.

**Byte 5 ff** The user data are located from byte 5 onwards to the end of the telegram.

#### 5.28.2.1.2 Response Telegram

Table 5-451 Response telegram

| Byte | Content | |
|---|---|---|
| 1 | Number of User Data | |
| 2 | Access | |
| 3 | Return Code | Error |
| 4 | | 0x00 |
| 5 | User Data 1st Byte | |
| 6 | User Data 2nd Byte | |
| n | User Data nth Byte | |

#### 5.28.2.1.3 User Data

The user data are located from byte 5 onwards to  end of the telegram.

#### 5.28.2.1.4 Reading and Writing Bytes

Depending on the telegram length and access, up to 28 bytes of user data can be transferred during reading and writing operations.

When bytes are being read and written, the user data appears in the telegram as of byte five.

#### 5.28.2.1.5 Reading Bits

When the system reads bits, it reads a byte, word or double word, based on the address width of the data area to be read.

The operating device masks out the requested bits, and displays the data in line with the display settings.

#### 5.28.2.1.6 Writing Bits

Only an individual bit is set or deleted.

The controller receives a bit mask and link information from the operating device via the request telegram. The bit is set or deleted in the target address using the bit mask and the link information.

The byte order of the bit mask for word addresses is oriented to the protocol parameters specified for the byte order.

Table 5-452 Writing to a byte address

| Byte | Content |
|---|---|
| 5 | Bit Mask |
| 6 | Logical Operation<br>0 = AND<br>1 = OR |

Table 5-453 Writing to a word address

| Byte | Content |
|---|---|
| 5 | Bit Mask LOW |
| 6 | Bit Mask HIGH |
| 7 | Logical Operation<br>0 = AND<br>1 = OR |

## 5.28.3 Programming

### 5.28.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.28.3.1.1 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-454 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 1 ms to 65535 ms | 1000 ms |

#### 5.28.3.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-455 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1000 ms to 65535 ms | 5000 ms |

#### 5.28.3.1.3 Station Number

Specifies the station number of the operating device within the PROFIBUS-DP structure. The station numbers 0 to 2 are reserved.

Table 5-456 Station number

| Configurable Values | Default Value |
|---|---|
| 3 to 124 | 3 |

#### 5.28.3.1.4 Telegram Length

The telegram length is set to the PROFIBUS configuration. Specigy the same value in the PROFIBUS programming software.

Table 5-457 Telegram length

| Configurable Values | Default Value |
|---|---|
| 8 Byte to 32 Byte | 20 Byte |

#### 5.28.3.1.5 Floating Point Format

Enter the interpretation form for floating point numbers. This is also the setting for a timer and counter in the Siemens DCS format.

Table 5-458 Floating point format

| Configurable Values | Default Value |
|---|---|
| Siemens Format | |
| IEEE Format | X |

#### 5.28.3.1.6 Byte Order

Specify the byte order for word and double-word addresses. (Siemens = High-Low, Bosch = Low-High)

Table 5-459 Byte order

| Configurable Values | Default Value |
|---|---|
| Low-High | X |
| High-Low | |

#### 5.28.3.1.7 Adress Width

Specify the address width you want the operating device to use when accessing controller addresses.

Table 5-460 Adress width

| Configurable Values | Default Value |
|---|---|
| 1 = Byte Address | |
| 2 = Word Address | X |
| 4 = Doppel-Word Address | |

### 5.28.3.2 System Parameters

#### 5.28.3.2.1 Poll Area

Limits applying to the poll area:

- The variable must be word-oriented.
- The area must be contiguous.
- The controller must be able to access this area in bit-mode.
- The operating device must be able to access this area in word-mode.

See chapter “Wort-orientierter Pollbereich“ on page 2-89.

### 5.28.4 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

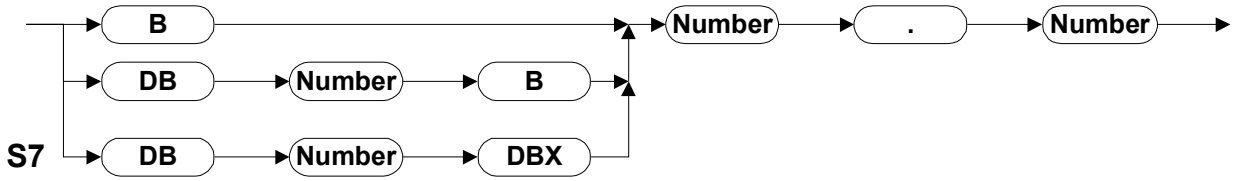



Figure 5-61 Syntax diagram for bit access, PROFIBUS-DP.

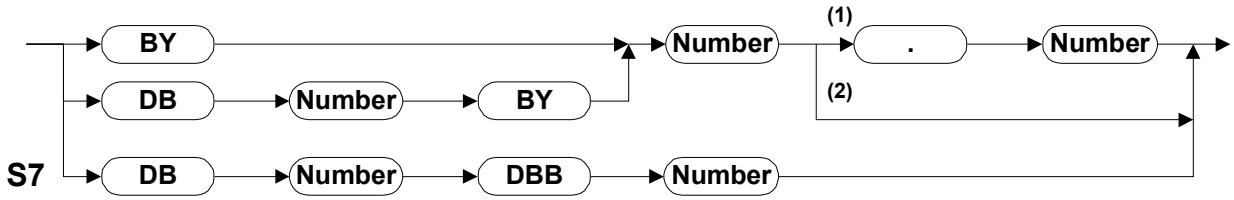



Figure 5-62 Syntax diagram for byte access, PROFIBUS-DP.

**1** The number in front of the point is a word or double-word address. The number after the point specifies the byte number within the word/double word.

**2** The number in front of the point is a byte address.

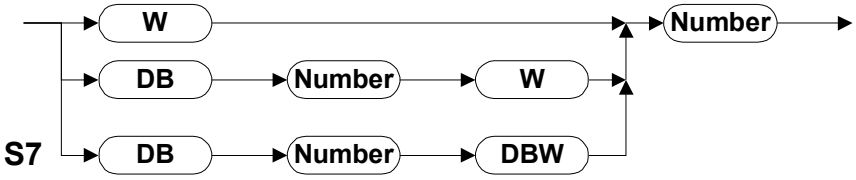



Figure 5-63 Syntax diagram for word access, PROFIBUS-DP.

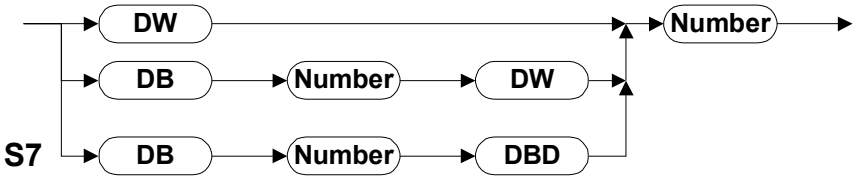



Figure 5-64 Syntax diagram for double-word access, PROFIBUS-DP

## 5.28.5 Physical Interfacing

### 5.28.5.1 Pin Assignment

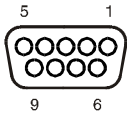



Figure 5-65 9 pin D-SUB female connector strip

Connector in the operating device: 9 pin D-SUB female connector.

Table 5-461 Pin assignment PROFIBUS-DP

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | nc | Not Connected |
| 3 | RxD/TxD-P | Received Data / Transmitted Data Plus |
| 4 | CNTR-P | Repeater Control Signal Plus |
| 5 | DGND | Data Transmission Potential |
| 6 | VP | Supply Voltage of Terminators Plus |
| 7 | nc | Not Connected |
| 8 | RxD/TxD-N | Received Data / Transmitted Data Minus |
| 9 | CNTR-N | Repeater Control Signal Minus |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.28.5.2 Cable X2 - PROFIBUS-DP

In the wiring depicted below, the potential difference between the data reference potentials DGND of all connections are NOT to exceed +/- 7 V.

Ensure that no compensating current flow through the bus cable shield. Install a separate equipotential bonding conductor.

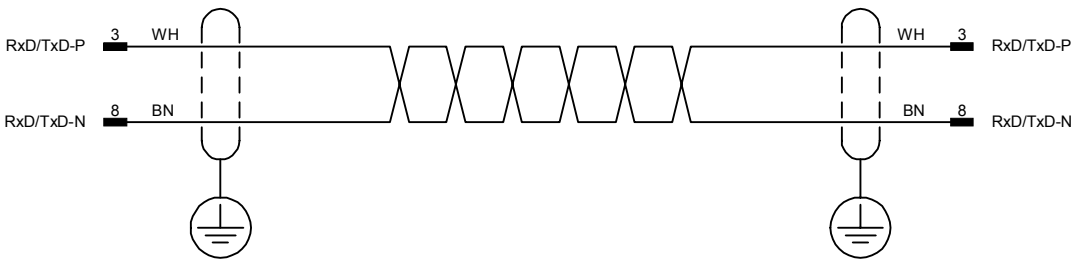



Figure 5-66 Connecting cable PROFIBUS-DP

There are two cable specifications for PROFIBUS-FMS and PROFIBUS-DP:

Table 5-462 Cable specification for PROFIBUS

| Parameter | Cable type A | Cable type B |
|---|---|---|
| Wave Impedance | 135 to 165 Ohm (for f = 3 to 20 MHz) | 100 to 135 Ohm (for f > 100 MHz |
| Cable capacity | < 30 pF/m | < 60 pF/m |
| Wire cross-section | > 0.34 mm2 | > 0.22 mm2 |
| Loop Impedance | < 110 Ohm/km | --- |
| Signal attentuation | max. 9 dB | max. 9 dB |
| Cable type | twisted-pair 1 x 2 / 2 x 2 / 1 x 4 wires | twisted-pair1x 2 / 2 x 2 / 1 x 4 wires |
| Shielding | Copper braided shielding or braided shielding + foil shielding | Copper braided shielding or braided shielding + foil shielding |

Cable recommendations:

Table 5-463 Cable recommendations for PROFIBUS

| Field of Application | Manufacturer | Order Number |
|---|---|---|
| Standard | Siemens | 6XV1 830-0AH10 |
| Trailing cable | Siemens | 6XV1 830-3BH10 |

Connector recommendations:

Table 5-464 Connector recommendations for PROFIBUS

| Manufacturer | Order Number |
|---|---|
| Siemens | 6ES79 0BA20-0XA0 |

#### 5.28.5.2.1 Transfer Speed and Line Length

With the PROFIBUS, data can be transferred using different transfer speeds. However, the higher the transfer speed, the shorter the maximum permitted line length. The values listed in the following table apply to the cable type A which is more closely specified in DIN E 19245 part 3.

Table 5-465 Transfer speed versus line length for PROFIBUS

| Baud Rate (Bit/s) | Line Length (m) |
|---|---|
| 187 500 | 1000 |
| 500 000 | 400 |
| 1 500 000 | 200 |
| 3 000 000 | 100 |
| 6 000 000 | 100 |
| 12 000 000 | 100 |

### 5.28.6 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-466 Error Messages for PROFIBUS-DP

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | | |
| | 1 | Slave is currently not ready | |
| | 2 | Packets out of sequence | |
| | 3 | Protocol framing error | |
| | 4 | Timeout | |
| | 5 | CRC error | |
| | 6 | Parity error | |
| | 7 | Send process aborted | |
| | 8 | Receive process aborted | |
| | 9 | Buffer too small for cyclic data | |
| | 10 | No cyclic data defined | |
| | 12 | Cyclic data already defined | |
| | 15 | The selected protocol is not supported | |
| | 16 | Receive buffer overrun | |
| | 40 | Undefined system variable | |
| 50 | | Error initializing the SPC3 | |
| | 1 | Buffer too large | |
| | 2 | No initialization of SPC3 | |
| | 4 | No memory for telegram buffer | |
| 60 | | No configuration from master | |
| 61 | | Wrong input length | |
| 62 | | Wrong output length | |
| 63 | | Error in configuration data, reparameterization required | |
| 64 | | Protocol chip requires configuration update, reparameterization required. | |
| 65 | | No communication via protocol chip, reparameterization required. | |
| 66 | | Protocol chip reset, reparameterization required. | |

Table 5-466 Error Messages for PROFIBUS-DP

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 67 | | Watchdog time error, reparameterization required. | |
| 70 | | Operating device is not polled | |
| | 0 | Distinguishing feature for manufacturer | |
| | 1 | Distinguishing feature for manufacturer | |
| 71 | xxx | No response to order.<br>xxx = variable number | |
| 100 | | Base no. for error from PLC function block. PLC error is added to 100. The subcode indicates the offset value for the access, during which the error occurred. | |
| | e g. 102 | Access to DB via FB111 / FB112 DB does not exist | |

## 5.28.7 Applications

The controller program, which is usually a function block, must handle the requests of the operating device in line with the data profile.

The details depend on the controller. The following sections explain the controller-specific applications that have been developed to date.

The device data base (GSD) file SE03081A.GSD can be used to set the parameters of the operating devices in the PLC software. This file is available in a subdirectory of the programming software and in our Internet download area.

### 5.28.7.1 Siemens S7 Controllers

The following dialog boxes and the way in which they are used may vary in the different versions of Step7 software. The procedure for defining a PROFIBUS DP slave is the same in all versions, but is not described in this documentation. The dialog boxes depicted here were developed for version 5.1 of an S7-300 controller.

#### 5.28.7.1.1 Hardware Configurator

To integrate the operating device into the PROFIBUS DP structure, you must firstly introduce the operating devices into the system.

Proceed as follows:

1. Start the Hardware Configurator in S7.
2. From the **Options** menu, select the menu item **Install New GSD**.

The following dialog opens.

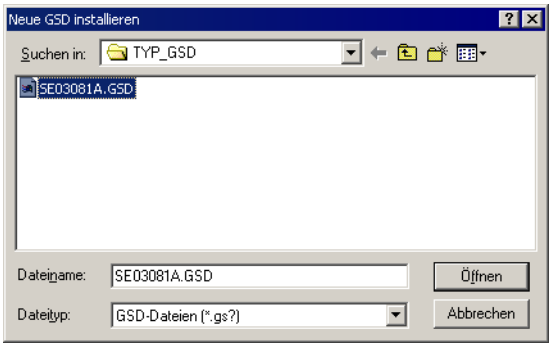



Figure 5-67 Dialog 'Install New GSD'

3. From your TSwin directory (C:\program files\TSwin) navigate to the subdirectory ..\FBs\Profibus\TYP_GSD.
4. Select the file SE03081A.GSD.
5. Click 'Open' to confirm your selection.

In the hardware catalog, the operating device is then listed as follows:

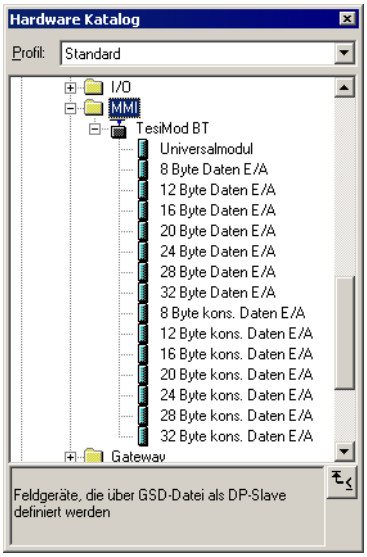



Figure 5-68 Hardware catalog

To integrate the operating device into PROFIBUS-DP, do the following:

1. Click on the TesiMod BT item and, keeping the mouse button pressed, drag and drop this item to the icon for the PROFIBUS DP master system.

The pointer becomes a cross.

2. Release the mouse button.

The following dialog opens.

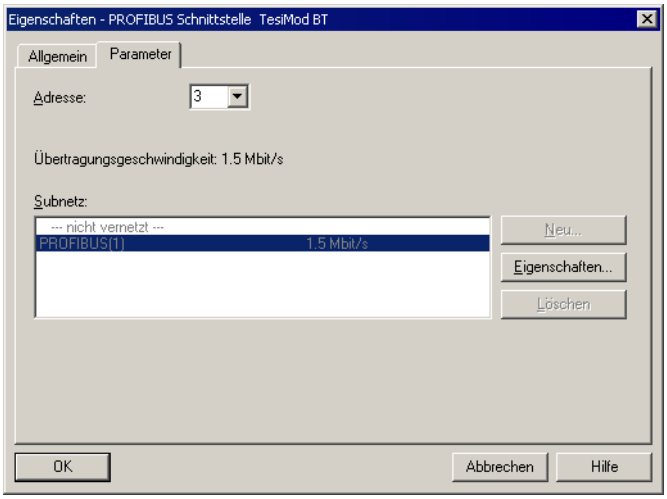



Figure 5-69 Dialog 'Properties - PROFIBUS interface TesiMod BT

3. Specify an address for the operating device (3).
4. Click OK to confirm your actions.

The hardware configurator now looks as shown below:

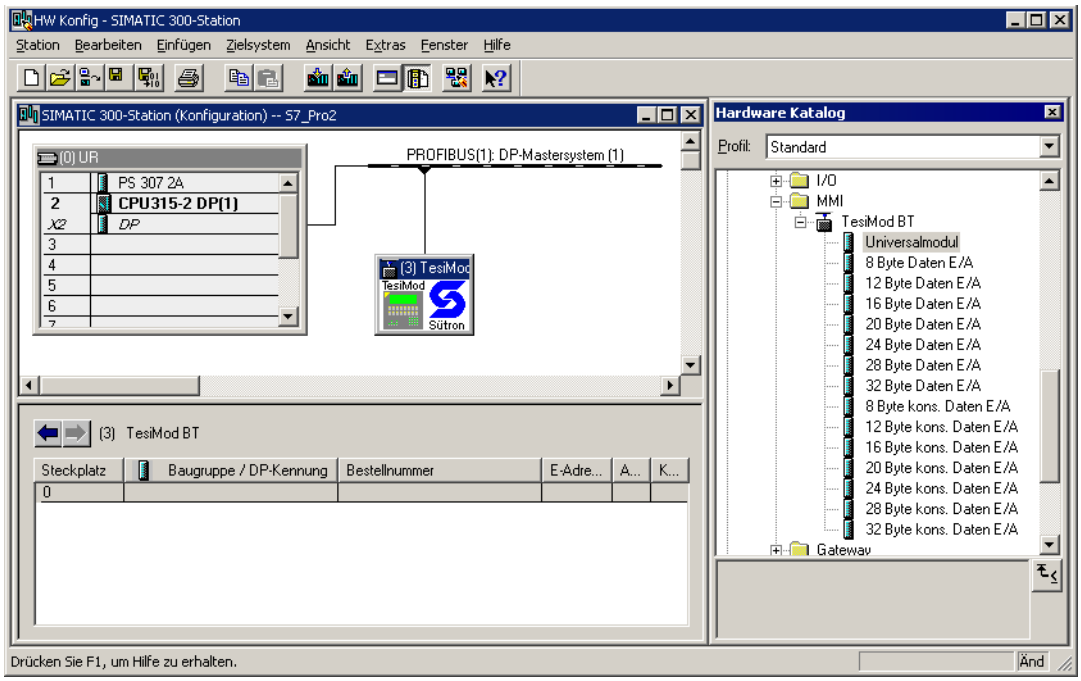



Figure 5-70 Hardware configuration

You must also set the parameters for the TesiMod operating device as a DP slave. Proceed as follows:

1. Click on the element Universal Module and, keeping the mouse button pressed, drag and drop the element to the top line in the table.

The pointer becomes a cross.

Release the mouse button.

The item is entered into the table.

2. Select the menu item Object Properties from the Edit menu.

3. Specify the properties as shown below.

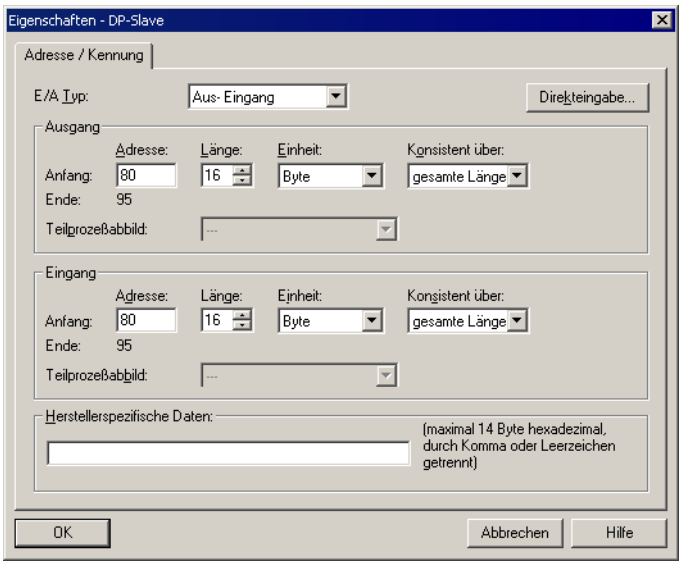



Figure 5-71 Dialog 'Properties - DP Slave'

You can select your entries for address, length, and unit as needed. The settings depicted below generate the value 191 in the ID byte.

#### 5.28.7.1.2 PROFIBUS Function Blocks

You need Sütron function blocks to interpret and evaluate the data. The cyclical call sequence of the function blocks must be adhered to.

#### 5.28.7.1.3 Importing the STL Source Files

Import the STL files supplied with the product in the Simatic Manager.

Proceed as follows:

1. Select the **Sources** folder in the Simatic Manager.
2. From the **Insert** menu, select the menu item **External Source**.

The following dialog opens.

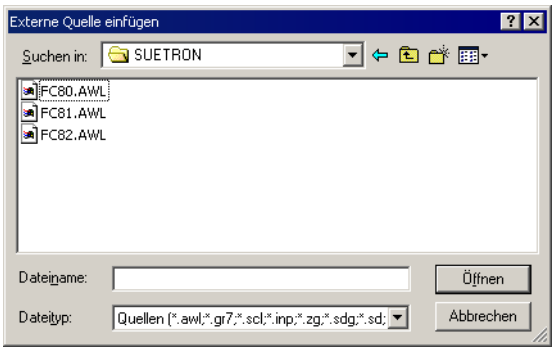



Figure 5-72 Dialog 'Insert External Source'

The function blocks FC80, FC81, and FC82 were available up to Version 2.31. As of Version 2.33, only the function block FC70 is valid.

3. Select the corresponding STL files and select Open to confirm.

The names are now entered in the Sources folder in the S7 Manager.

4. Open the STL files, and compile and convert them into the S7 function block format.

#### 5.28.7.1.4 General Functioning

The peripheral data is processed using the functions SFC14 and SFC15 of the S7 CPU. SFC14 reads the peripheral data, and SFC15 writes the data to the periphery. FC80 takes on the data provided by SFC14 and calls the read or write function, and transfers the data read to SFC15. The local data stack of FC80, FC81, and FC82 is used to process protocol data.

SFC14, FC70 (FC80) and SFC15 must be called cyclically in the program.

The following cyclical call sequence must be adhered to:

**1** SFC14

**2** FC70 (FC80)

**3** SFC15

The functions FC80, FC81, and FC82 use the register-indirect, cross-area address form. If interrupt-controlled program calls are permitted in the program cycle, the contents of the address registers 1 and 2, and possibly also the local data stack, may need to be saved, in addition to the contents of both accumulators.

The operating device can access the controller data on a bit, byte, word, or double-word basis. Bit access is possible to a byte address. As the protocol profile itself does not transfer data type code, these are transferred using the variable numbers. Each variable is uniquely identified using a variable number. This number is defined during programming.

The following graphic shows how the function blocks work.

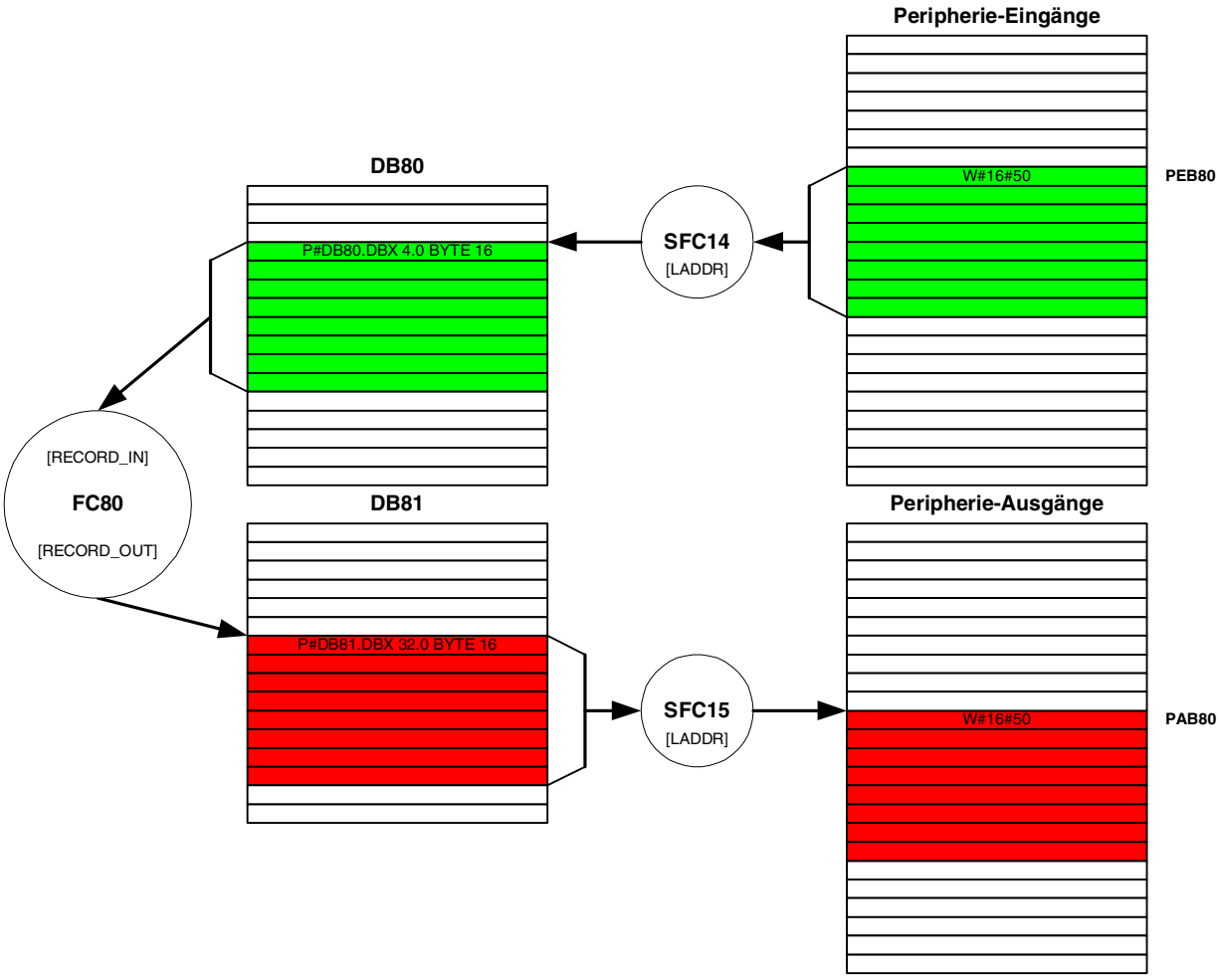



Figure 5-73 How the function blocks work

#### 5.28.7.1.5 SFC14 Functioning

SFC14 reads the data from the peripheral inputs, starting with the start address (LADDR) and copies the data to a specific target (RECORD). The amount of data to be copied is contained in the RECORD parameter.

Table 5-467 SFC14 parameters

| Name | Meaning |
|---|---|
| LADDR | Specifies the start address for the peripheral inputs of the operating device (hexadecimal) |
| RET_VAL | Return value of the SFC14 in case of an error |
| RECORD | Copy target for the read peripheral data |

#### 5.28.7.1.6 FC80 Functioning

FC80 reads the data transferred from the operating device from the copy target RECORD of SFC14. Based on the telegram transferred, it carries out a read or write access. It then transfers the data to be transferred to the operating device to the source data area of SFC15.

Table 5-468 FC80 parameters

| Name | Meaning |
|---|---|
| Record_In | Start address for the input data (= parameter RECORD of the SFC14) |
| Record_Out | Start address for the output data (= parameter RECORD of the SFC15) |

#### 5.28.7.1.7 SFC15 Functioning

SFC15 reads the data from the source RECORD and copies the data to the peripheral outputs, starting with the address LADDR. The amount of data to be copied is contained in the RECORD parameter.

Table 5-469 SFC15 parameters

| Name | Meaning |
|---|---|
| LADDR | Specifies the start address for the peripheral outputs of the operating device (hexadecimal) |
| RET_VAL | Return value of the SFC15 in case of an error |
| RECORD | Copy source for the data to be transferred |

#### 5.28.7.1.8 Example for an OB1

The following example refers to the connection of one operating device to the PROFIBUS-DP.

```
...//Call SFC 14 [LADDR] := W#16#50 [RET_VAL] := MW62 [RECORD] := P#DB80.DBX
4.0 BYTE 16//Call FC 80 [RECORD_IN] := P#DB80.DBX 4.0 BYTE 16 [RECORD_OUT] :=
P#DB81.DBX 32.0 BYTE 16//Call SFC 15 [LADDR] := W#16#50 [RECORD] := P#DB81.DBX
32.0 BYTE 16 [RET_VAL] := MW64... BE
```

#### 5.28.7.1.9 Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

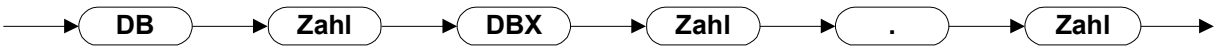



Figure 5-74 Bit access for PROFIBUS using a Siemens S7

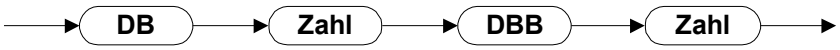



Figure 5-75 Byte access for PROFIBUS using a Siemens S7

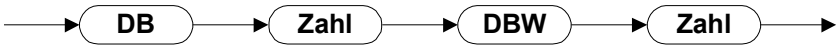



Figure 5-76 Word access for PROFIBUS using a Siemens S7

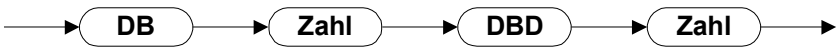



Figure 5-77 Double-word access for PROFIBUS using a Siemens S7

### 5.28.7.2 Siemens S5 Controllers

The PLC program communicates with the PROFIBUS DP via the input/output peripheral area.

A separate IN/OUT data channel is assigned to each participant on the PROFIBUS DP (each connected operating device). The assignment is made via the parameterization of the PROFIBUS-DP master module in the Siemens PLC. Controllers in the S5 series usually use the module IM308B or IM308C.

#### 5.28.7.2.1 Parameter Settings for IM308B

A device type file for the COMET200 programming software is available to parameterize the IM308B.(BT081ATD.200)

The 'Configuration' option is used to configure the terminal of the DP slave.

The following parameters are specified:

1. Position of the operating device in the peripheral area, i.e. the I/O addresses on which the operating device is located.
2. The DP identifier via module 0

Table 5-470 The DP identifier via module 0

| Item | Value |
|---|---|
| I/O | X |
| Length | 4, 6, 8, 14, 16 |
| Format | Word |
| Consistency | 0 Word Consistency |

3. Data for the parameterization telegram are not applicable, no entry.

Using a program module, this module configuration is loaded into the module with the parameter settings of the entire master module.

#### 5.28.7.2.2 Data Consistency

A data consistency over the entire length set must be applied for exchanging data between the operating device and the master module.

However, the master modules IM308B and IM308C only ensure a consistency with a data width of up to one word.

Program-specific measures in the PROFIBUS DP driver of TesiMod operating devices ensure consistency up to the maximum data length which can be specified, that is 32 bytes.

#### 5.28.7.2.3 PLC Program

**Evaluation of the Control Bytes:**

The PLC program must cyclically poll the peripheral area that is assigned to the operating device. Using the sequential number, it must check whether a new request has been received from the operating device.

**FB110** carries out this task.

FB110 is parameterized with the peripheral address of the corresponding operating device, to ensure that only one function block is required to connect several operating devices.

FB110 must also copy bytes 1 and 2, unchanged, from the request to the response telegram, and 0x00 must be written to byte 3.

Take note of the consistency settings when reading and writing to the peripheral area. (Also see the COMET200 manual.)

**Processing user data:**

Separate read and write function blocks that are called by FB110 are used to process user data.

The read and write function blocks process the user data in line with the data profile.

**Error Handling:**

Errors can be entered in the return code, byte 4 of the response telegram. If no error occurs, byte 4 must be deleted.

One possible error is: DB does not exist.

#### 5.28.7.2.4 FB110 Evaluation Block

The description for this function block is for version 2.0 and higher (PROF02ST.S5D).

The function block (FB) uses MW246 - MW254 as scratch flag.

The function block also needs a separate data word for each operating device. The data word is transferred as a parameter during the call. The telegram sequential number is saved in this data word.

FB110 cyclically checks the contents of byte 1 - bits 5 to 7.

If the value 0 is contained here, the telegram number memory is reset.

If in byte 1, bits 5 to 7 are not equal to the content of the telegram number memory, a new request telegram has been received from the operating device, and this must be evaluated and a response sent.

FB110 is called cyclically in OB1 with the corresponding parameters for each operating device.

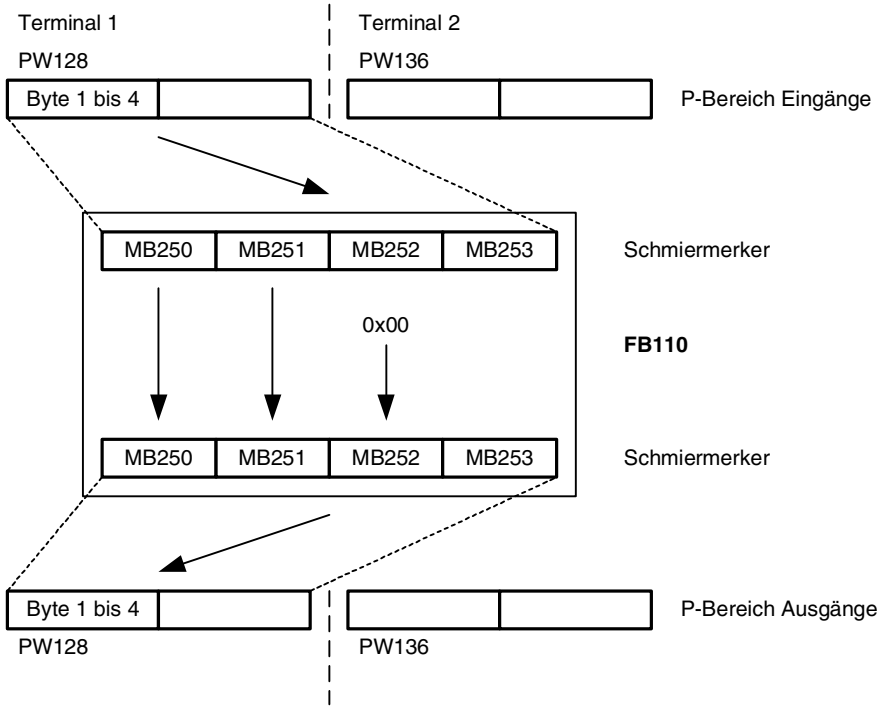



Figure 5-78 Structure of FB110

#### 5.28.7.2.5 FB111 - Reading from the Data Block

The description for this function block is for version 2.0 and higher (PROF02ST.S5D).

The function block interprets the following bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 5-471 FB111 - Byte code in byte 2

| Value | Meaning |
|---|---|
| 0 | DL - High Byte |
| 1 | DR - Low Byte |

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.

See chapter “Structure of the Data Profile“ on page 5-396.

#### 5.28.7.2.6 FB112 - Writing to the Data Block

The description for this function block is for version 2.0 and higher (PROF02ST.S5D).

The function block interprets the following bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 5-472 FB111 - Byte code in byte 2

| Value | Meaning |
|---|---|
| 0 | DL - High Byte |
| 1 | DR - Low Byte |

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.
– Byte 5 and
– Byte 6 contain the bit mask for the logical operation.
– Byte 7 contains the logical instruction (AND / OR).

See chapter “Structure of the Data Profile“ on page 5-396.

#### 5.28.7.2.7 Protocol Parameters for the Siemens S5 Series

For the protocol, specify the parameters shown in the figure below.

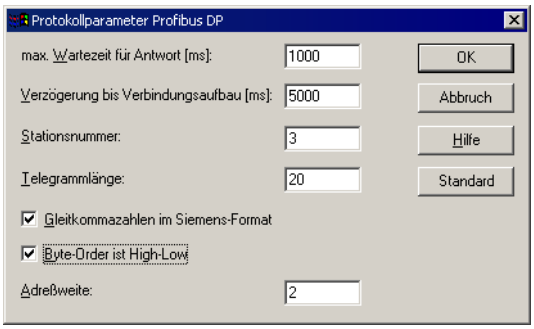



Figure 5-79 Protocol parameters for PROFIBUS using a Siemens S5

#### 5.28.7.2.8 Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

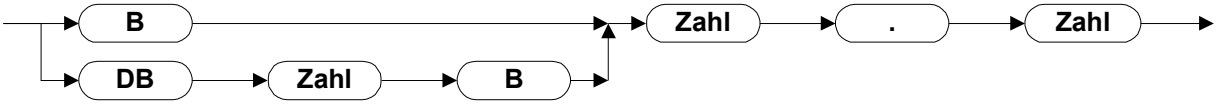



Figure 5-80 Bit access for PROFIBUS using a Siemens S5

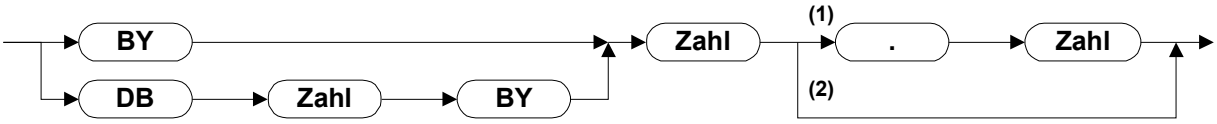



Figure 5-81 Byte access for PROFIBUS using a Siemens S5

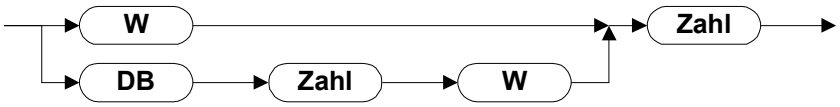



Figure 5-82 Word access for PROFIBUS using a Siemens S5

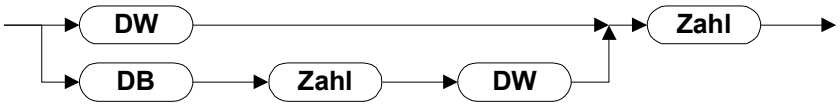



Figure 5-83 Double-word access for PROFIBUS using a Siemens S5

#### 5.28.7.3 Rexroth Controllers

The PLC program communicates with the PROFIBUS DP via the input/output peripheral area.

Each participant, including each operating device in the PROFIBUS DP, is assigned an IN and OUT data channel.

The channel is assigned using the parameterization of the Bosch controller's PROFIBUS DP master module. The module MP-DP12 is used in Bosch controllers.

##### 5.28.7.3.1 Configuration in WINSPS

**Evaluation of the control bytes in the PLC Program:**

The PLC program must cyclically poll the peripheral area that is assigned to the operating device. Using the sequential number, it must check whether a new request has been received from the operating device. In addition, bytes 1 and 2 must be copied, unchanged, from the request telegram to the response telegram, and 0x00 must be written to byte 3.

You require the following modules for this task. They are contained in a subfolder of the programming software's installation folder.

Table 5-473 Function blocks for the programming software WINSPS

| Controller | Function Block |
|---|---|
| CL200 | ..\FBs\Profibus\BOSCH\WINSPS\CL200\BT_PB2.pxl |
| CL300 | ..\FBs\Profibus\BOSCH\WINSPS\CL345\BT_PB345.pxl |
| CL400 | ..\FBs\Profibus\BOSCH\WINSPS\CL345\BT_PB345.pxl |
| CL500 | ..\FBs\Profibus\BOSCH\WINSPS\CL345\BT_PB345.pxl |
| SoftPLC | ..\FBs\Profibus\BOSCH\WINSPS\PLC\BT_PBPLC.pxl |

**Error Handling in the PLC Program:**

Errors can be entered in the return code, byte 4 of the response telegram. If no error occurs, byte 4 must be deleted. Possible errors are:

– DB does not exist.

**Function Blocks Supplied:**

You must configure the operating device as the slave using 'n Byte kons. Daten E/A' (n byte cons. data I/O) in the DP master module.

If you are using interrupts, you must save the scratch flags and the four registers used in the interrupt OB.

**Inserting the Library Files in WINSPS**:

1. Start WinSPS.
2. Copy the corresponding pxl file to the ZSO directory of the PLC project.

You can only copy the file to the appropriate project directory as modules of the incorrect controller type are not recognized!

3. Assign the library in the toolbar.

**Example:**

```
FC10, R BT_PB345
```

4. Open the editor in the PLC software.

**Example:** OB1

Select the PROFIBUS block from the 'Edit/Parameter list' menu.

**Parameterizing the call-up function:**

**Example:** For two operating devices:

```
...
;DEF für Gerät 1
DEF 10,-EZ_Basisn
DEF 10,-AZ_Basisn
DEF DB50,-DBNR
DEF 0,-WDNR
DEF 20,-TLNG
;DEF für Gerät 2
DEF 10,-EZ_Basisn2
DEF 10,-AZ_Basisn2
DEF DB50,-DBNR2
DEF 0,-WDNR2
DEF 20,-TLNG2
;Aufruf Gerät 1
BA -BT_345,5 FC10
P0 W -EZ_Basisn
P1 W -AZ_Basisn
P2 -DBNR
P3 W -WDNR
P4 W -TLNG
;Aufruf Gerät 1
BA -BT_345,5 FC10
P0 W -EZ_Basisn2
P1 W -AZ_Basisn2
P2 -DBNR2
P3 W -WDNR2
P4 W -TLNG2
...
```

**Function Block BT_PB345**:

The function block BT_DP345 is used to decode the transfer protocol of the operating devices. It ensures consistent data transfer.

When you program the controller, note that a total of 64 bytes as of the address DB[P2] W[P3] are reserved for processing the protocol. Other program components cannot use this area!

The function block BT_PB345 uses the following parameters:

Table 5-474 Parameters for function block BT_PB345

| Parameter | Function |
|---|---|
| P0 | EZ Base Address |
| P1 | AZ Base Address |
| P2 | Data block for storing the EZ/AZ data |
| P3 | Base Address in Data Block [P2] |
| P4 | Telegram Length<br>corresponds to the number of EZ/AZ data of the slave configuration (8, 12, 16, 20, 28, or 32 bytes) |

#### 5.28.7.3.2 Configuration in PROFI

Table 5-475 Function blocks for the programming software PROFI

| Controller | Function Block |
|---|---|
| CL200 | ..\FBs\Profibus\BOSCH\PROFI\CL200\BT_MAIN.PBO<br>..\FBs\Profibus\BOSCH\PROFI\CL200\BT_READ.PBO<br>..\FBs\Profibus\BOSCH\PROFI\CL200\BT_WRITE.PBO<br>..\FBs\Profibus\BOSCH\PROFI\CL200\OB1.PBO |
| CL300 | ..\FBs\Profibus\BOSCH\PROFI\CL350400/BT_MAIN.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_READ.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_WRITE.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.PCO |
| CL400 | ..\FBs\Profibus\BOSCH\PROFI\CL350400/BT_MAIN.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_READ.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_WRITE.PCO<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.PCO |
| CL500 | ..\FBs\Profibus\BOSCH\PROFI\CL500/BT_MAIN.P5O<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_READ.P5O<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\BT_WRITE.P5O<br>..\FBs\Profibus\BOSCH\PROFI\CL350400\OB1.P5O |

### Function Block BT_MAIN

Structure of the block:

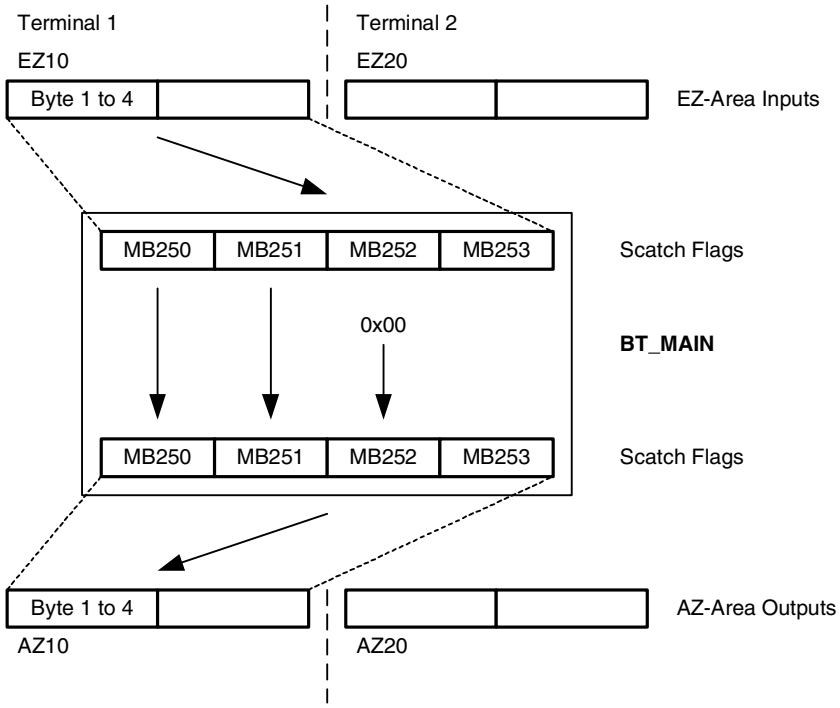



Figure 5-84 Structure of the BT_MAIN

### Function Block BT_MAIN Call-Up

**Example:** Call-up in OB1

```
;OB1 Organisationsbaustein
;***************************************
;Profibus-DP-Koomunikation mit Bediengerät
;Beispiel zur Einbindung im OB1
;***************************************
;Befehle notwendig für Profibus
L W EZ2,A ;Adresse muss mit Koppeladresse übereinstimmen
T W A,AZ2 ;nur für CL400
;Einmal pro Bediengerät aufrufen
BA -BT_MAIN,4 ;Aufruf für das erste Bediengerät
; +---+
P0 W K10 ; < ! Adresse des Eingangsbereichs
P1 W K10 ; < ! Adresse des Ausgangsbereichs
P2 W DB0 ; < ! Nummer des Datenbausteins
P3 W D0 ; < ! Datenwortnummer
; +---+
PE
```

**Function Block BT_READ**

The function block BT_READ interprets the subsequent bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 5-476 Byte code in byte 2

| Value | Meaning |
|---|---|
| 0 | Odd Address - Low Byte |
| 1 | Even Address - High Byte |

– Byte 3 contains the data block number.
– Byte 4 contains the data word number within the DB.

The program module doubles the data word number for the even-numbered byte number in the DB.

**Function Block BT_WRITE**

The function block BT_WRITE interprets the subsequent bytes in the telegram as follows:

– Byte 2, bit 0 is interpreted as a byte code for a byte access to a word address.

Table 5-477 Byte code in byte 2

| Value | Meaning |
|---|---|
| 0 | Odd Address - Low Byte |
| 1 | Even Address - High Byte |

– Byte 3 contains the data block number within the DB.
– Byte 4 contains the data word number within the DB (0 to 255).
– Byte 5 and
– Byte 6 contain the bit mask for the logical operation.
– Byte 7 contains the logical instruction (AND / OR).

**Parameterization of the BM-DP12 Module**

Set the parameters for the module using the Bosch DP software.

The device data base (GSD) file SE03081A.GSD which is supplied is directly read in by the DP software. This means that the data required to set the parameters of the operating devices are automatically available.

Select the operating device with the required data width.

The function block copies bytes 1 and 2, unchanged, from the request telegram to the response telegram, and writes 0x00 to byte 3.

The function block uses MW248 to MW254 as scratch flags.

For each operating device, the program block also requires any data word of a data block. The data word is transferred as a parameter during the call. The telegram sequential number is saved in this data word.

The function block cyclically checks the content of byte 1 – bits 5 to 7.

If the value 0 is contained here, the telegram number memory is reset.

If in byte 1, bits 5 to 7 are not equal to the content of the telegram number memory, a new request telegram has been received from the operating device, and this must be evaluated and a response sent.

The function block is called cyclically in OB1 with the corresponding parameters for each operating device.

#### 5.28.7.3.3 Protocol Parameters for BM DP12

Set the following parameters for the protocol:

Table 5-478 Protocol parameters for the Bosch CL series

| Parameter | Value |
|---|---|
| Maximum Waiting Time for Response [ms] | 1000 |
| Delay Until Connection Set-Up [ms] | 5000 |
| Station Number | 3 |
| Telegram Length | 16 |
| Floating Point Number in the Siemens Format | Inactive |
| Byte Order is High-Low | Inactive |
| Address Width | 2 |

Set the parameters using the Bosch DP software. The supplied device data base file SUET081A.GSD is directly imported by the DP software. Therefore, the data required to set the parameters of the operating devices are available in the DP software. You can specify 8, 12, or 16 bytes for the telegram length.

#### 5.28.7.3.4 Protocol Parameters for the Bosch CL Series

Set the following parameters for the protocol:

Table 5-479 Protocol parameters for the Bosch CL series

| Parameter | Value |
|---|---|
| Maximum Waiting Time for Response [ms] | 1000 |
| Delay Until Connection Set-Up [ms] | 5000 |
| Station Number | 3 |
| Telegram Length | 20 |
| Floating Point Number in the Siemens Format | Inactive |
| Byte Order is High-Low | Inactive |
| Address Width | 2 |

#### 5.28.7.3.5 Defining Variables

Specify the variable addresses in either the hexadecimal notation or using the following syntax formats:

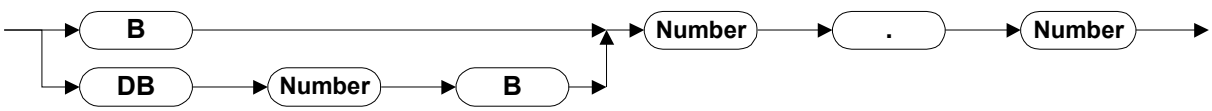


Figure 5-85 Bit access for PROFIBUS using the Bosch CL series

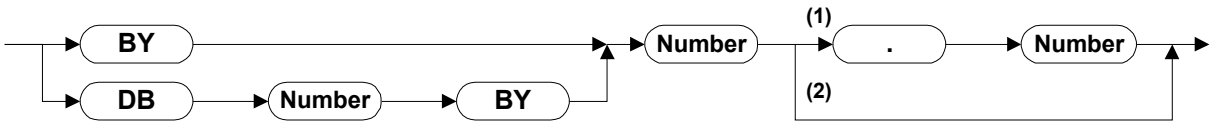



Figure 5-86 Byte access for PROFIBUS using the Bosch CL series

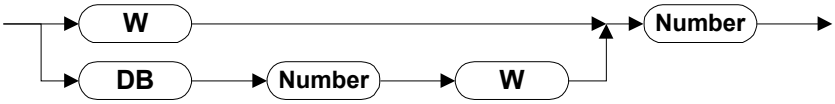



Figure 5-87 Word access for PROFIBUS with the Bosch CL series

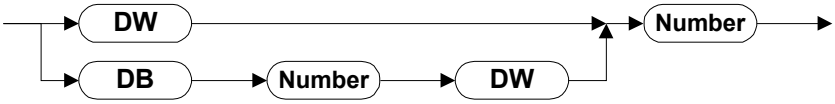



Figure 5-88 Double-word access for PROFIBUS using the Bosch CL series

In the variable list of the programming software, you can also enter the addresses in hexadecimal notation:

Table 5-480 Hexadecimal notation for addresses

| Variable Name | Address (hex) | Low-Bit | High-Bit | PLC Access | PLC Address |
|---|---|---|---|---|---|
| Var1 | DW H124B | | | Double Word | DB18 D150 to D153 |
| Var2 | W H124B | | | Word | DB18 D150 and D151 |
| Var3 | BY H124B | | | Byte | DB18 D151 |
| Var4 | BY H124B | 1 | 1 | Bit | DB18 D150 Bit 5 |
| Var5 | B H124B | 13 | 13 | Bit | DB18 D151 Bit 5 |

## 5.29 Siemens S5 PG (AS511)

The S5 PG AS511 protocol provides you

– random read and write access to all controller data
– bit access to all byte-oriented data types
– byte access to all data words in a data block.

When the system writes to individual bits and individual bytes of a data word within a data block, a read-access is performed first. Then, the entire data structure can be accessed for a write operation. During this type of access, you must therefore take care that the operating device and the controller do not modify individual bits in a byte (or individual bytes in a data word).

The size of the address area depends on the controller being used.

This protocol supports a connection to the following Simatic S5 types.

Table 5-481 Supported Simatic S5 types

| Controller Type | CPU |
|---|---|
| SIMATIC S5-90U | 8-Bit CPU |
| SIMATIC S5-95U | 8-Bit CPU |
| SIMATIC S5-100U | CPU100 / 8-Bit CPU |
| | CPU102 / 8-Bit CPU |
| | CPU103 / 8-Bit CPU |
| SIMATIC S5-115U | CPU941 / 8-Bit CPU |
| | CPU942 / 8-Bit CPU |
| | CPU943 / 8-Bit CPU |
| | CPU944 / 8-Bit CPU |
| | CPU945 / 8-Bit CPU with 20-Bit Address Area |
| SIMATIC S5-135U | CPU922 / 16-Bit CPU |
| | CPU928 / 16-Bit CPU |
| | CPU928B / 16-Bit CPU |
| SIMATIC S5-155U | CPU948 / 20-Bit CPU |

The following Simatic S5 types are **not** supported by this protocol.

Table 5-482 Simatic S5 types not supported

| Controller Type | CPU |
|---|---|
| SIMATIC S5-135U | CPU921 / 16-Bit CPU |

### 5.29.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the controller's CPU.

Table 5-483 Data types for Siemens S5 PG (AS511)

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | E | Bit Access (Read-only) |
| Input Byte | EB | Byte Access (Read-only) |
| Input Word | EW | Word Access (Read-only) |
| Input Double-Word | ED | Double-Word Access (Read-only) |
| Output Bit | A | Bit Access |
| Output Byte | AB | Byte Access |
| Output Word | AW | Word Access |
| Output Double-Word | AD | Double-Word Access |
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Flag Double-Word | MD | Double-Word Access |
| Data Word | DW | Word Access |
| Data-Word Left (High) | DL | Word Access |
| Data-Word Right (Low) | DR | Word Access |
| Data Double-Word | DD | Double-Word Access |
| Timer | T | Word Access (Read-only) |
| Counter | Z | Word Access (Read-only) |

**Counter:**

For counters, a distinction is made between variables which have been assigned a counter address and variables which have been assigned another controller address.

When accessing counter addresses, the counter value is interpreted in binary format and the control bits of the counter are masked out.

To avoid control bits from being erased, accesses to counter addresses should be **read-only**.

The counter value is interpreted in BCD-code. This allows this value to be transferred within the controller program to the counter by means of the accumulator. Since the values are available in a Siemens compliant format, this service should be used to indirectly write counter starting values.

**Timer:**

Timer values are made up of a time value and a time base.

The operating device reads the 2-byte sized variable and converts it internally into an imaginary, unsigned 4-byte variable that represents the time value for the base 0.01 seconds. The operating device makes a distinction between accesses to a timer address and accesses to other controller addresses.

When accessing timer addresses, the operating device interprets the time value in binary format. When accessing another controller address, the operating device interprets the time value in BCD code.

To avoid control bits from being erased, accesses to timer addresses should be **read-only**.

Accesses to other addresses should be used to indirectly write timer starting values, since the values are provided in the Siemens compliant format.

Before the operating device writes a timer value to the controller, it converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base. In addition, the operating device makes a distinction between writing the timer value to a timer address and writing it to another controller address.

## 5.29.2 Programming

### 5.29.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.29.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-484 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.29.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-485 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.29.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-486 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.29.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-487 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.29.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-488 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.29.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-489 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 1000 ms |

CPUs equipped with 2 PG interfaces (e.g. CPU928B with PG module) are used during system commissioning thus keeping the PG interface available for program debugging.

Please note that the interfaces are interacting (see Siemens CPU manual). Forexample, if a PLC program is analyzed by means of the STATUS-function on thefirst interface of the CPU, this will cause the speed of protocol handling on thesecond interface to decrease significantly. With the STATUS-function, you can, so to speak, operate the PLC program in single-step-mode, i.e. the result of every program line is displayed on the screen.

In order to maintain the connection, you need to increase the "maximum waiting time for response" to about 5 seconds. If the normal time-out period is used, the operating terminal will generate a communication error message.

In this case each transmission requires 3-4 seconds, in contrast to a normal communication cycle which requires approximately 60ms. This means a slow-down of the interface by a factor of 50!

#### 5.29.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-490 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 0 s to 20 s | 2 s |

#### 5.29.2.1.8 Fast Data Block Access

This parameter specifies whether a fast data block access is used.

Table 5-491 Fast data block access

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

The following applies to the fast data block access:
The base address for each data block being used is determined only once and this information is stored temporarily in a local buffer with 10 positions. Any subsequent accesses continue to operate with the information stored in the local buffer. The information in the buffer is erased when the operating device is rebooted or when a resynchronization is carried out after a communication error has occurred.
In this case, do not modify data blocks dynamically or compress the memory while the connection between the operating device and the controller is still active!

The following applies if an operating device and a programming unit are simultaneously connected to the controller by means of a multiplexer: the address location of the data blocks changes whenever you change the values of a data block using the programming device and transfer the data block to the controller again.

For useful information concerning this topic refer to the „Automating with SIMATIC S5“ books series written by Hans Berger.

#### 5.29.2.1.9 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

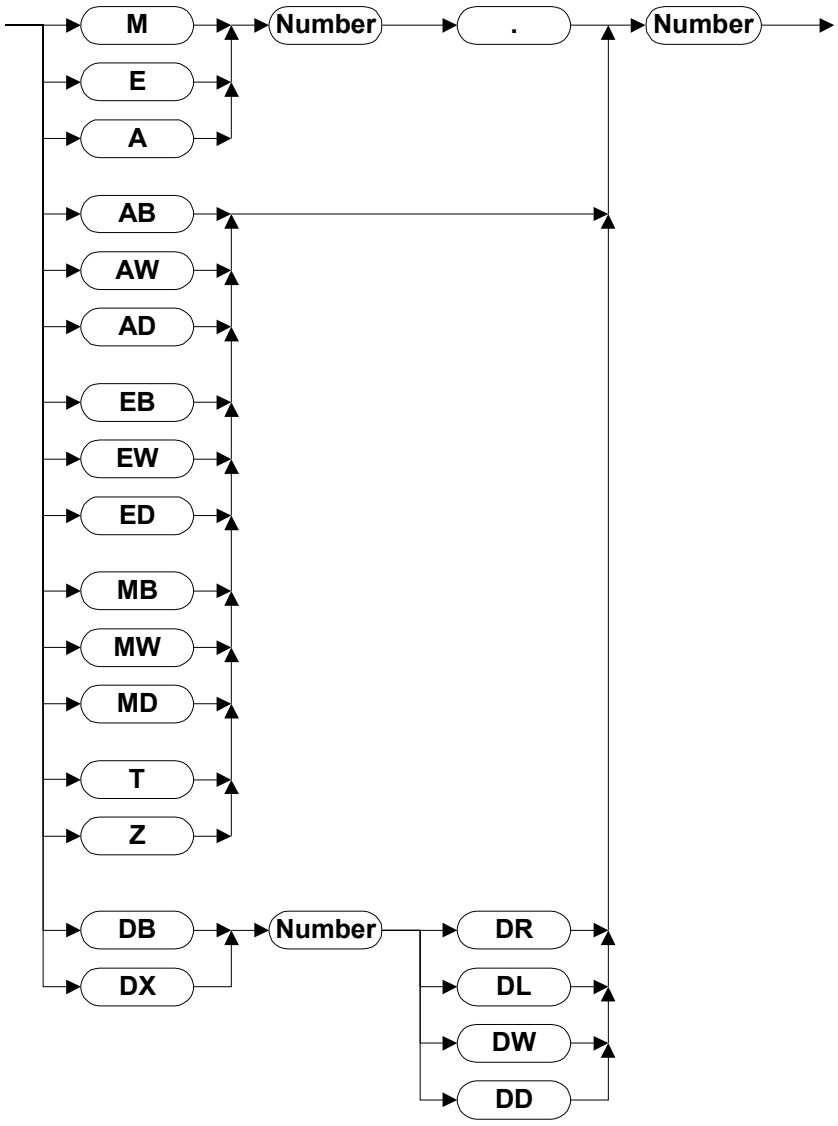



Figure 5-89 Syntax diagram

## 5.29.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.29.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-492 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.29.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-493 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

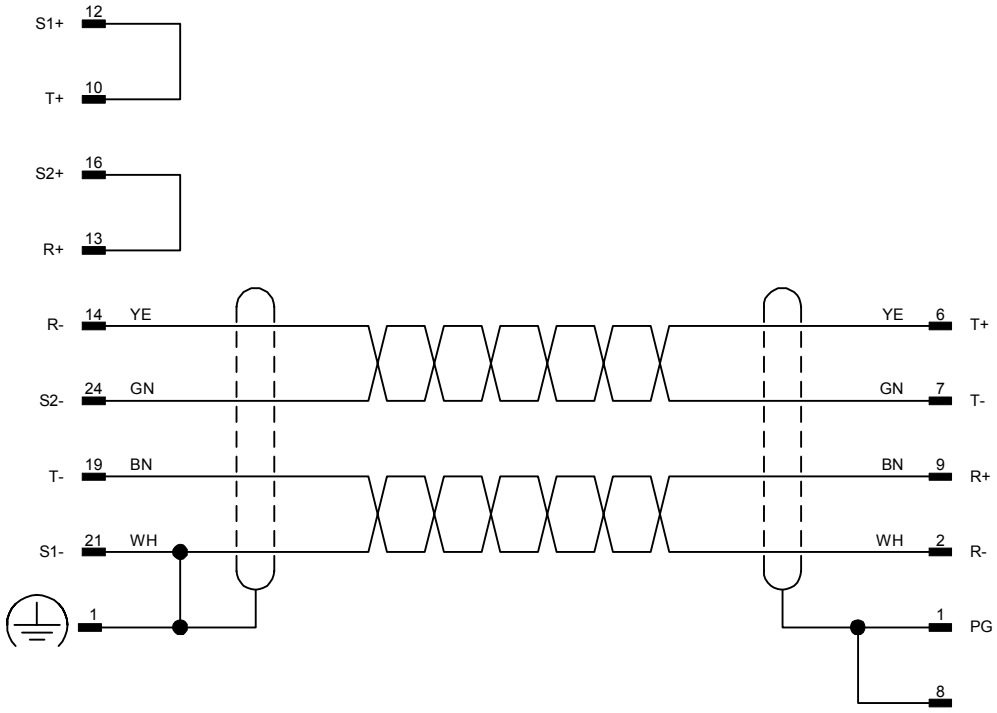
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.29.3.3 Cable X3 SER1 TTY / 20 mA - Siemens S5 PG

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device
transmitter active
receiver active

Siemens
Simatic S5
transmitter passive
receiver active




D-SUB
male connector
25 pin

D-SUB
male connector
15 pin

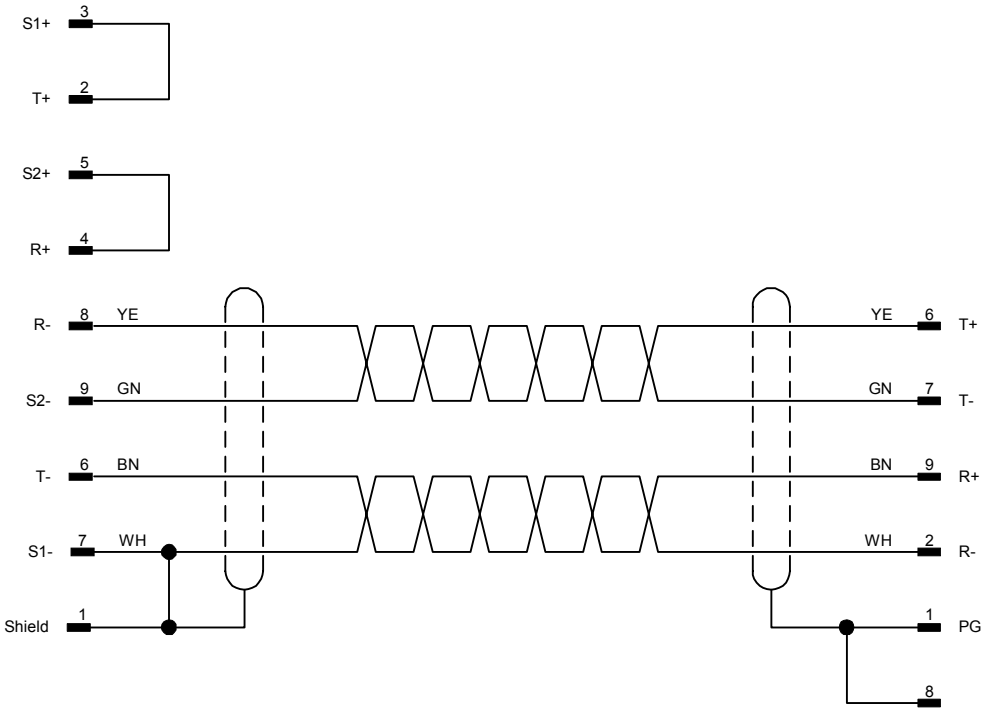
Both ends of the shield are connected to the metallic housing.

#### 5.29.3.4 Cable X2 TTY / 20 mA - Siemens S5 PG

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device
transmitter active
receiver active

Siemens
Simatic S5
transmitter passive
receiver active




D-SUB
male connector
9 pin

D-SUB
male connector
15 pin

Both ends of the shield are connected to the metallic housing.

### 5.29.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-494 Error messages for Siemens S5 PG

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | |
| 2 | | Packets out of sequence | |
| 3 | | Protocol frame error | |
| 4 | | Waiting time elapsed (timeout) | Connection broken. |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 17 | | NAK from controller despite repetitions | |
| 40 | | System variable error | Undefined system variable |
| Siemens-specific error messages | | | |
| 50 | | Outside of range | Address outside of range of data block. |
| | XXXX | The subcode contains the number of the data block. | |
| 51 | | Wrong number of data received | |
| 52 | | Unknown function | |
| 53 | | Wrong mode of operation | |
| 54 | | Data block does not exist. | |
| | XXXX | The subcode contains the number of the data block. | |
| 55 | | Communication has reached higher level. | |
| 56 | | Communication has reached lower level. | |
| 57 | | Received invalid response from controller during connection setup phase. | |
| | XXXX | The subcode contains the received character. | |

Table 5-494 Error messages for Siemens S5 PG

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 58 | | Received invalid response from controller during transmission phase. | |
| | XXXX | The subcode contains the received character. | |
| 59 | | Received invalid response from controller during disconnect phase. | |
| | XXXX | The subcode contains the received character. | |
| 60 | | CPU 921 detected | CPU 921 not supported |
| 61 | | Wrong addressing | Only part of the requested address range is available. |

## 5.30 Siemens S7 MPI

The Siemens S7 MPI protocol offers random read and write access to almost all of the controller data.

This protocol supports a connection between one operating device and up to 16 MPI participants.

In this configuration, the operating device always functions as a client.

Use the MPI interface to connect the operating device to the MPI bus.

You can import the variables from another controller to the Siemens S7 MPI variable list. For this purpose, set up the external controller before you set up Siemens S7 MPI.

The external variables are imported when you open the Siemens S7 MPI variable list. You should note, however, that no check is carried out on the syntax of the imported variables.

Make sure to follow the guidelines for setting up a MPI system!

### 5.30.1 Data Types

Direct access is possible to the following data types. Only part of the address space is available for operating devices with a Z80 or a 386 CPU.

Table 5-495 Siemens S7 MPI data types for operating devices with a Z80 and 386 CPU

| Type | Mnemonic | From | Up to | | From | Up to | Access |
|---|---|---|---|---|---|---|---|
| Input | E | 0.0 | 16383.7 | | | | Read/Write |
| | EB | 0 | 16383 | | | | |
| | EW | 0 | 16382 | | | | |
| | ED | 0 | 16380 | | | | |
| Output | A | 0.0 | 16383.7 | | | | |
| | AB | 0 | 16383 | | | | |
| | AW | 0 | 16382 | | | | |
| | AD | 0 | 16380 | | | | |
| Flag | M | 0.0 | 16383.7 | | | | |
| | MB | 0 | 16383 | | | | |
| | MW | 0 | 16382 | | | | |
| | MD | 0 | 16380 | | | | |
| Counter | Z | 0 | 512 | | | | Read-only |
| Timer | T | 0 | 512 | | | | Read-only |

Table 5-495 Siemens S7 MPI data types for operating devices with a Z80 and 386 CPU

| Type | Mnemonic | From | Up to | | From | Up to | Access |
|---|---|---|---|---|---|---|---|
| Data Block | DB | 1 | 255 | DBX | 0.0 | 8191.7 | Read/Write |
| | | | | DBB | 0 | 8191 | |
| | | | | DBW | 0 | 8190 | |
| | | | | DBD | 0 | 8188 | |

Table 5-496 Siemens S7 MPI data types for operating devices with a RISC CPU

| Type | Mnemonic | From | Up to | | From | Up to | Access |
|---|---|---|---|---|---|---|---|
| Input | E | 0.0 | 16383.7 | | | | Read/Write |
| | EB | 0 | 16383 | | | | |
| | EW | 0 | 16382 | | | | |
| | ED | 0 | 16380 | | | | |
| Output | A | 0.0 | 16383.7 | | | | |
| | AB | 0 | 16383 | | | | |
| | AW | 0 | 16382 | | | | |
| | AD | 0 | 16380 | | | | |
| Flag | M | 0.0 | 16383.7 | | | | |
| | MB | 0 | 16383 | | | | |
| | MW | 0 | 16382 | | | | |
| | MD | 0 | 16380 | | | | |
| Counter | Z | 0 | 512 | | | | Read-only |
| Timer | T | 0 | 512 | | | | Read-only |
| Data Block | DB | 0 | 8192 | DBX | 0.0 | 65535.7 | Read/Write |
| | | | | DBB | 0 | 65535 | |
| | | | | DBW | 0 | 65534 | |
| | | | | DBD | 0 | 65532 | |

## 5.30.2 Programming

### 5.30.2.1 Protocol Parameters

#### 5.30.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-497 Baud rate

| Configurable Values (Baud) | Default Value |
|---|---|
| 9600 | |
| 19200 | |
| 38400 | |
| 93750 | |
| 187500 | X |
| 500000 | |
| 750000 | |
| 1500000 | |

Set the baud rate to 187500 baud and modify the controller setting accordingly!

#### 5.30.2.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-498 Delay until Connection Set-Up

| Configurable Values | Default Value |
|---|---|
| 5 s to 255 s | 5 s |

#### 5.30.2.1.3 Participant Address of Terminal

This parameter specifies the MPI address of the operating device.

Table 5-499 Participant address of terminal

| Configurable Values | Default Value |
|---|---|
| 3 to 126 | 3 |

The station number of the operating device can be changed during operation. This requires that you set up the system variable **ComSlaveNr** in a mask. After changing the value of the system variable on the operating device, reinitialize the operating device. You can do this by:

– powering the device down and up again or
– using the system variable **Boot**.

Change the value of the system variable **Boot** to "1" to reinitialize the operating device immediately. The value of the system variable **ComSlaveNr** is overwritten when the project is downloaded again.

#### 5.30.2.1.4 Highest Participant Address

This parameter specifies the highest station number that can be used within the MPI bus structure. This value must be the same for every participant on the bus.

Table 5-500 Highest participant address

| Configurable Values | Default Value |
|---|---|
| 15 | |
| 31 | X |
| 63 | |
| 126 | |

#### 5.30.2.1.5 Offline Operation

This parameter prevents the operating device from displaying the system message COMMUNICATION ERROR when a communication connection fails. Zeroes (0) are displayed in a mask for the variable values of the controller affected by the communication failure.

Table 5-501 Offline operation

| Configurable Values | Default Value |
|---|---|
| OFF | X |
| ON | |

Create error messages with the message numbers 9901 to 9916 if you wish to be notified when a connection fails. Message number 9901 corresponds to the failure of connection 1, message number 9902 to the failure of connection 2, and so on.

#### 5.30.2.1.6 Connections

The operating device is capable of maintaining 16 simultaneous connections with communication-capable modules on the MPI bus.

The connection list consists of 16 rows for the connection data and 4 columns for the connection parameters.

For a direct connection (without subnet), you only need to specify the participant address. For all other settings, you can keep the preset default values.

Table 5-502 Connection list for Siemens S7 MPI

| Column | Meaning | Default Value |
|---|---|---|
| Connection | Connection Number | 1 to 16 |
| Participant Address | Address of the Communication Module | |
| Segment ID | Subnet in a S7-300/400 Controller | 1 |
| Slot | Slot Number of the Module | 0 |
| Rack Number | Rack Number of the Controller | 0 |

#### 5.30.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

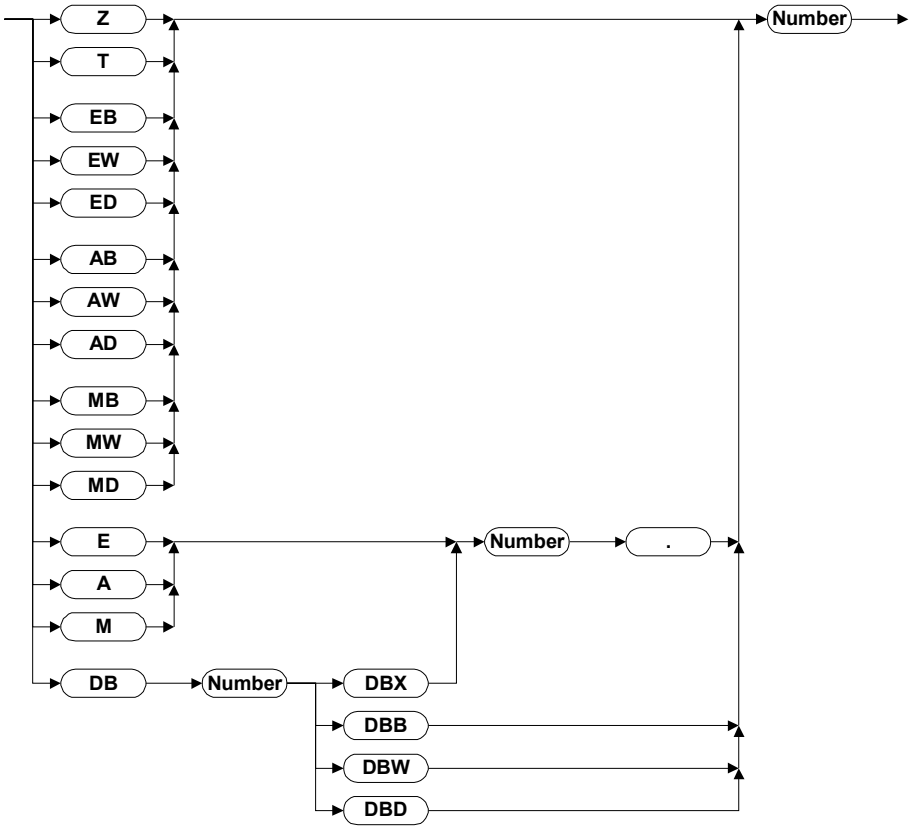



Figure 5-90 Syntax diagram

#### 5.30.2.3 System Parameters

##### 5.30.2.3.1 Poll Area

For the address of the poll area, you need to specify a byte address or a word address in either the flag area or in a data block.

Table 5-503 Byte-oriented poll area for Siemens S7 MPI

| Word Address | Reference | High Byte |
|---|---|---|
| Byte Address + 0 | MB 12 | Write Coordination Byte |
| Byte Address + 1 | MB 13 | Message Channel Low-Byte |
| Byte Address + 2 | MB 14 | Message Channel High-Byte |
| Byte Address + 3 | MB 15 | Function Key LEDs 1 to 4 |
| Byte Address + 4 | MB 16 | Function Key LEDs 5 to 8 |
| Byte Address + 5 | MB 17 | Function Key LEDs 9 to 12 |
| Byte Address + 6 | MB 18 | Function Key LEDs 13 to 16 |
| Byte Address + 7 | MB 19 | Function Key LEDs 17 to 20 |

Table 5-503 Byte-oriented poll area for Siemens S7 MPI

| Word Address | Reference | High Byte |
|---|---|---|
| Byte Address + 8 | MB 20 | Function Key LEDs 21 to 24 |
| Byte Address + 9 | MB 21 | Function Key LEDs 25 to 28 |
| Byte Address +10 | MB 22 | Function Key LEDs 29 to 32 |

Table 5-504 Word-oriented poll area for Siemens S7 MPI

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | MW 20 | Write Coordination Byte | Reserved |
| Word Address + 2 | MW 22 | Message Channel High-Byte | Message Channel Low-Byte |
| Word Address + 4 | MW 24 | Function Key LEDs 1 to 4 | Function Key LEDs 5 to 8 |
| Word Address + 6 | MW 26 | Function Key LEDs 9 to 12 | Function Key LEDs 13 to 16 |
| Word Address + 8 | MW 28 | Function Key LEDs 17 to 20 | Function Key LEDs 21 to 24 |
| Word Address + 10 | MW 30 | Function Key LEDs 25 to 28 | Function Key LEDs 29 to 32 |

#### 5.30.2.3.2 Status Messages

For the address of the parallel message system, you need to specify a byte address or a word address in either the flag area or in a data block (MB, MW, DBB or DBW).

For example:

Table 5-505 Parallel message system for Siemens S7 MPI

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | MW 10 | Messages 9 to 15 | Messages 0 to 8 |
| Word Address + 1 | MW 12 | Messages 24 to 31 | Messages 16 to 23 |
| Word Address + 2 | MW 14 | Messages 40 to 47 | Messages 32 to 39 |

### 5.30.3 Physical Interfacing

A special MPI interface is used to connect the operating devices to the MPI bus. Make sure to follow the guidelines for setting up a MPI bus system.

The operating device does not provide any means for termination. The termination must therefore be connected externally.

Table 5-506 Pin assignment X2 MPI

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not connected |
| 2 | nc | Not connected |
| 3 | RxD/TxD-P | Received data / transmitted data - plus |
| 4 | CNTR-P | Control signal for repeater - plus |
| 5 | DGND | Data transmission potential |
| 6 | VP | Supply voltage of terminating resistors - plus |
| 7 | nc | Not connected |
| 8 | RxD/TxD-N | Received data / transmitted data - minus |
| 9 | CNTR-N | Control signal for repeater - minus |

#### 5.30.3.1 Cable X2 - Siemens S7 MPI

You can use any cables that comply with the following parameters.

Table 5-507 Parameters for MPI cables

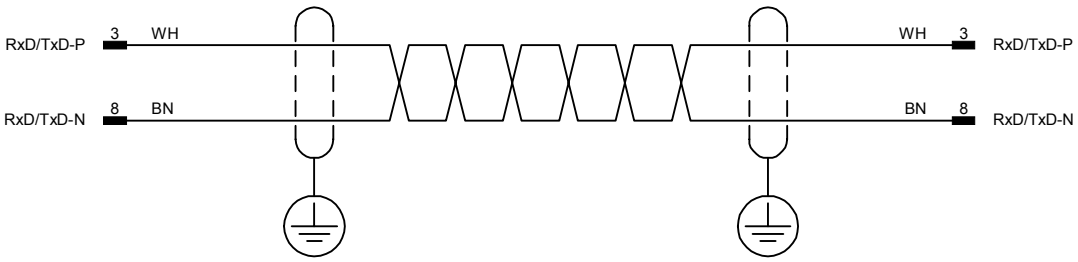
| Parameter | Value |
|---|---|
| Loop Impedance | 110 Ohm/km |
| Working Capacitance | 30 nF/km |
| Wave Impedance | 150 Ohm |

The maximum length of one segment is not allowed to exceed 50 m (164.042 feet).

For further installation information, refer to the Siemens **Manual on installing the S7-400 and M7-400**.

Operating device

Siemens
PLC S7-MPI




D-SUB
male connector
9 pin

D-SUB
male connector
9 pin

### 5.30.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-508 Error messages for Siemens S7 MPI

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| Error messages occurring during connection setup. | | | |
| 50 | 10 | Addressed station is not on the bus. | |
| | 20 | Connection of remote station disconnected. | |
| Error messages occurring while sending the telegram. | | | |
| 60 | 10 | Queue full. | |
| | 20 | No credit. | |
| 61 | 1/33/49 | SAP is blocked. | Not all of the participants have the same highest participant address setting. |
| | 2/34/50 | No resource to send data. | |
| | 3/35/51 | No service activated. | |
| 62 | 159 | Access not possible. | |
| | 175 | Duplicate token detected. | |
| | 191 | Response buffer too small. | |
| 70 | | Controller disconnected the connection. | |
| 80 | | Interrupt error reported. | |
| | <256 | Interrupt bit of low byte. | |
| | >255 | Interrupt bit of high byte. | |
| 90 | 10 | The addressed participant does not respond within 5 seconds. | |
| | 20 | Data are invalid. | |
| 100 | | Error class in high byte, error code in low byte. | |
| 110 | | Error class in high byte, error code in low byte. | |

Table 5-508 Error messages for Siemens S7 MPI

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 111 | | Read PDU variable. | |
| | 01 | Hardware error. | |
| | 03 | Object access not allowed. | |
| | 05 | Invalid address. | |
| | 06 | Data type not supported. | |
| | 07 | Data type not consistent (type><data type) | |
| | 10 | Object does not exist or wrong range length. | |
| 120 | | Write PDU variable.Error class in high byte, error code in low byte. | |
| | 01 | Hardware error. | |
| | 03 | Object access not allowed. | |
| | 05 | Invalid address. | |
| | 06 | Data type not supported. | |
| | 07 | Data type not consistent (type><data type) | |
| | 10 | Object does not exist or wrong range length. | |

## 5.31 Siemens S7 MPI (HMI adapter)

The Siemens S7 MPI (HMI adapter) protocol provides random read and write access to almost all data of the controller.

The protocol supports a connection between one TesiMod operating device and up to four MPI participants.

In this configuration, the TesiMod operating device always functions as a client.

Use the serial interface X3 SER1 RS232 or X2 RS232 to connect the TesiMod operating device to the HMI adapter. And connect the adapter to the MPI interface of a controller or of the MPI bus. The TesiMod operating device communicates with the HMI adapter through a 3964R-based protocol. During this process, the operating device always acts as the master.

Make sure to follow the guidelines for setting up a MPI system!

### 5.31.1 Data Types

Direct access is possible to the following data types. The characters xxx indicate values that depend on the address ranges or on the controller type being used.

Table 5-509 Siemens S7 MPI data types

| Type | Mnemonic | From | Up to | | From | Up to | Access |
|---|---|---|---|---|---|---|---|
| Input | E | 0.0 | xxx.7 | | | | Read/Write |
| | EB | 0 | xxx | | | | |
| | EW | 0 | xxx | | | | |
| | ED | 0 | xxx | | | | |
| Output | A | 0.0 | xxx.7 | | | | |
| | AB | 0 | xxx | | | | |
| | AW | 0 | xxx | | | | |
| | AD | 0 | xxx | | | | |
| Flag | M | 0.0 | xxx.7 | | | | |
| | MB | 0 | xxx | | | | |
| | MW | 0 | xxx | | | | |
| | MD | 0 | xxx | | | | |
| Counter | Z | 0 | xxx | | | | Read-only |
| Timer | T | 0 | xxx | | | | Read-only |
| Data Block | DB | 1 | 255 | DBX | 0.0 | 8191.7 | Read/Write |
| | | | | DBB | 0 | 8191 | |
| | | | | DBW | 0 | 8190 | |
| | | | | DBD | 0 | 8188 | |

## 5.31.2 Programming

### 5.31.2.1 Protocol Parameters

#### 5.31.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-510 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.31.2.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-511 Delay until connection set-up

| Configurable Values | Default value |
|---|---|
| 0 s to 255 s | 5 s |

Increase the value for the waiting time depending on the number of participants.

#### 5.31.2.1.3 Participant Address of Terminal

This parameter specifies the MPI address of the operating device.

Table 5-512 Participant address of terminal

| Configurable Values | Default Value |
|---|---|
| 3 to 126 | 3 |

The station number of the operating device can be changed during operation. This requires that you set up the system variable **ComSlaveNr** in a mask. After changing the value of the system variable on the operating device, reinitialize the operating device. You can do this by:

– powering the device down and up again or

– using the system variable **Boot**.

Change the value of the system variable **Boot** to "1" to reinitialize the operating device immediately. The value of the system variable **ComSlaveNr** is overwritten when the project is downloaded again.

#### 5.31.2.1.4 Highest Participant Address

This parameter specifies the highest station number that can be used within the MPI bus structure. This value must be the same for every participant on the bus.

Table 5-513 Highest participant address

| Configurable Values | Default Value |
|---|---|
| 15 | |
| 31 | X |
| 63 | |
| 126 | |

#### 5.31.2.1.5 Connections

The TesiMod operating device can simultaneously support 4 connections with communication-enabled modules on the MPI bus.

The connection list consists of 4 rows for the connection data and 4 columns for the connection parameters.

For a direct connection (without subnet), only specify the participant address. For all other settings, you can keep the preset default values.

Table 5-514 Connection list

| Column | Function | Default Value |
|---|---|---|
| Connection | Connection Number | 1 to 4 |
| Participant Address | Address of the Communication Module | |
| Segment ID | Subnet in a S7-300/400 Controller | 1 |
| Slot | Slot Number of the Module | 0 |
| Rack Number | Rack Number of the Controller | 0 |

#### 5.31.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

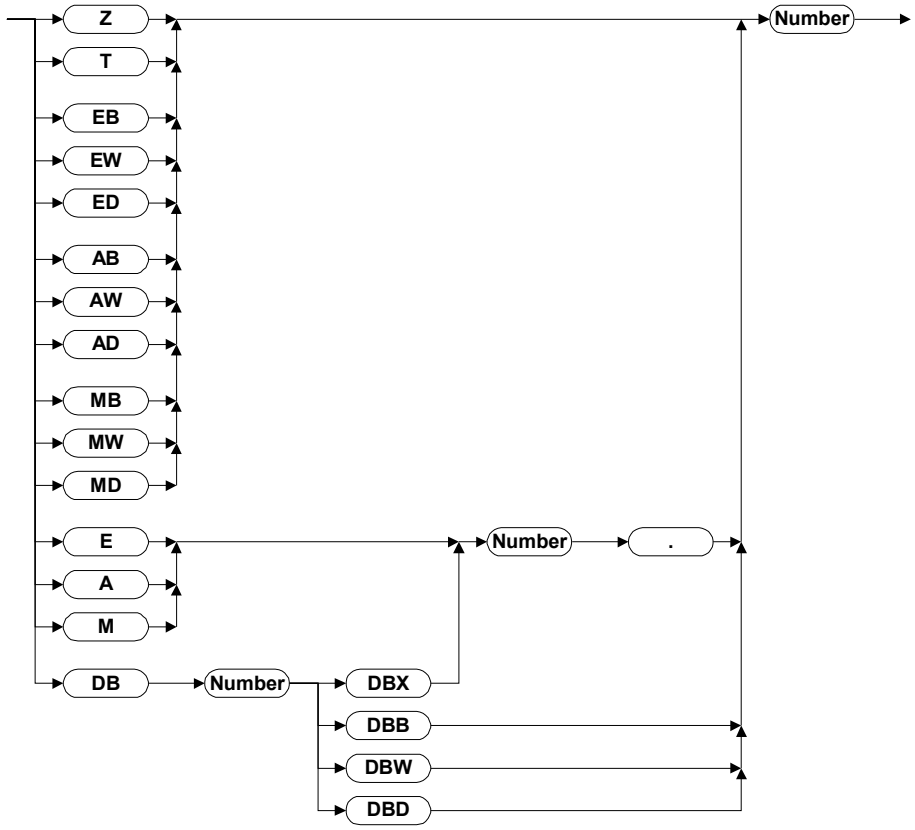



Figure 5-91 Syntax diagram

#### 5.31.2.3 System Parameters

##### 5.31.2.3.1 Poll Area

For the address of the poll area, you need to specify a byte address or a word address in either the flag area or in a data block.

Table 5-515 Byte-oriented poll area for Siemens S7 MPI

| Word Address | Reference | High Byte |
|---|---|---|
| Byte Address + 0 | MB 12 | Write Coordination Byte |
| Byte Address + 1 | MB 13 | Message Channel Low-Byte |
| Byte Address + 2 | MB 14 | Message Channel High-Byte |
| Byte Address + 3 | MB 15 | Function Key LEDs 1 to 4 |
| Byte Address + 4 | MB 16 | Function Key LEDs 5 to 8 |
| Byte Address + 5 | MB 17 | Function Key LEDs 9 to 12 |
| Byte Address + 6 | MB 18 | Function Key LEDs 13 to 16 |
| Byte Address + 7 | MB 19 | Function Key LEDs 17 to 20 |

Table 5-515 Byte-oriented poll area for Siemens S7 MPI

| Word Address | Reference | High Byte |
|---|---|---|
| Byte Address + 8 | MB 20 | Function Key LEDs 21 to 24 |
| Byte Address + 9 | MB 21 | Function Key LEDs 25 to 28 |
| Byte Address +10 | MB 22 | Function Key LEDs 29 to 32 |

Table 5-516 Word-oriented poll area for Siemens S7 MPI

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | MW 20 | Write Coordination Byte | Reserved |
| Word Address + 2 | MW 22 | Message Channel High-Byte | Message Channel Low-Byte |
| Word Address + 4 | MW 24 | Function Key LEDs 1 to 4 | Function Key LEDs 5 to 8 |
| Word Address + 6 | MW 26 | Function Key LEDs 9 to 12 | Function Key LEDs 13 to 16 |
| Word Address + 8 | MW 28 | Function Key LEDs 17 to 20 | Function Key LEDs 21 to 24 |
| Word Address + 10 | MW 30 | Function Key LEDs 25 to 28 | Function Key LEDs 29 to 32 |

#### 5.31.2.3.2 Status Messages

For the address of the parallel message system, you need to specify a byte address or a word address in either the flag area or in a data block (MB, MW, DBB or DBW).

For example:

Table 5-517 Parallel message system for Siemens S7 MPI

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | MW 10 | Messages 9 to 15 | Messages 0 to 8 |
| Word Address + 1 | MW 12 | Messages 24 to 31 | Messages 16 to 23 |
| Word Address + 2 | MW 14 | Messages 40 to 47 | Messages 32 to 39 |

## 5.31.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.31.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-518 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.31.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-519 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

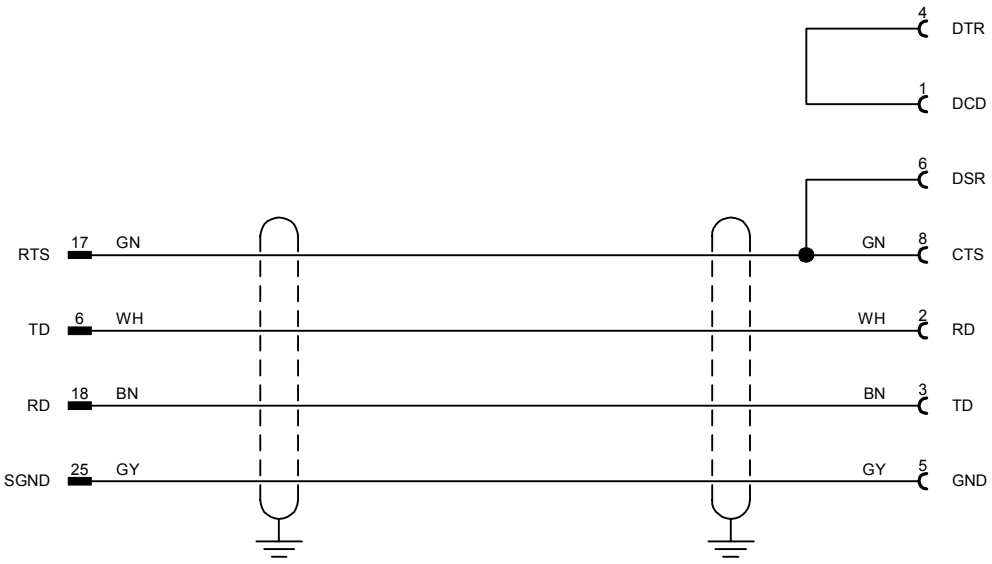
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.31.3.3 Cable X3 SER1 RS232 - Siemens S7 MPI (HMI adapter)

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Siemens S7
HMI adapter




D-SUB
male connector
25 pin

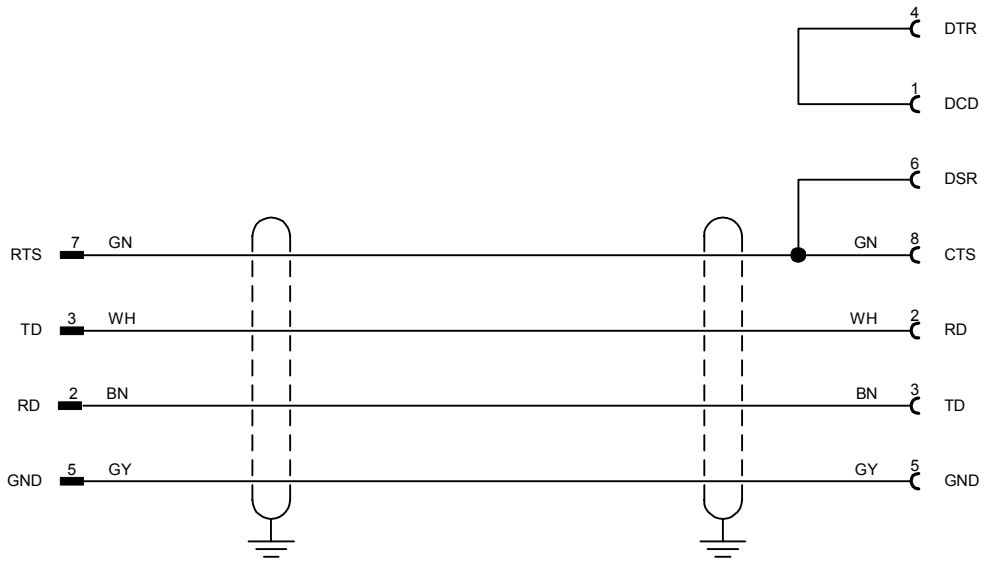
D-SUB
male connector
9 pin

#### 5.31.3.4 Cable X2 RS232 - Siemens S7 MPI (HMI adapter)

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Siemens S7
HMI adapter




D-SUB
male connector
9 pin

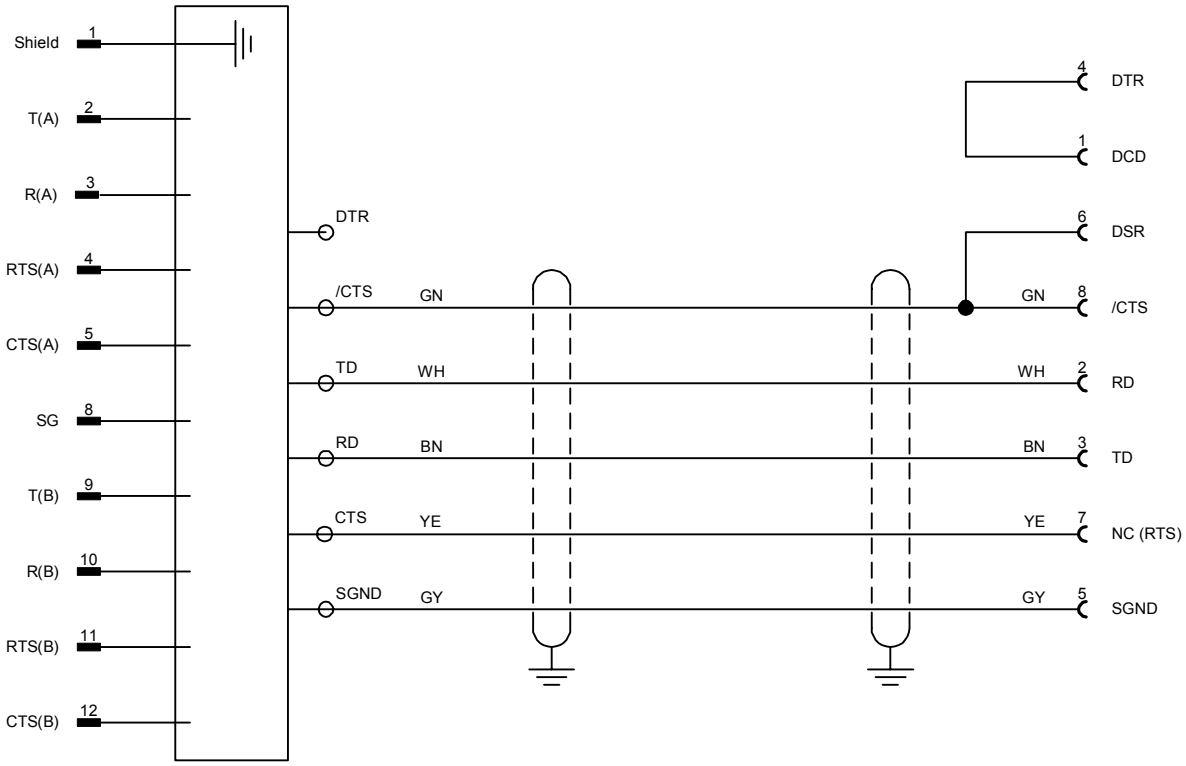
D-SUB
male connector
9 pin

### 5.31.3.5 Cable X2 RS485 - Siemens S7 MPI (HMI adapter)

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Siemens S7
HMI adapter




D-SUB
male connector
15 pin

D-SUB
male connector
9 pin

### 5.31.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-520 Error messages for Siemens S7 MPI (HMI adapter)

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong slave address or connecting cable not plugged-in properly |
| 2 | | Protocol error | Data packets out of sequence |
| 3 | | Protocol framing error | |
| 4 | | Waiting time elapsed (timeout) | Connection broken. |
| 5 | | CRC error or BCC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| 50 | | Error on 3964R protocol level | |
| | 50 | No acknowledgment | |
| | 51 | No acknowledgment data | |
| | 52 | No response | |
| | 55 | Waiting time for acknowledgment elapsed | |
| | 56 | Waiting time for acknowledgment data elapsed | |
| | 57 | Waiting time for response elapsed | |
| | 58 | Waiting time for response data elapsed | |
| 60 | | Return code for RESET in header | |
| 70 | | Return code for START in header | |
| 80 | | Return code for CONNECT in header | |
| 81 | | Return code 1 for CONNECT in data section | |

Table 5-520 Error messages for Siemens S7 MPI (HMI adapter)

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 82 | | Return code 2 for CONNECT in data section | |
| 83 | | Return code 3 for CONNECT in data section | |
| 84 | | Return code 4 for CONNECT in data section | |
| 90 | | Return code for DISCONNECT in header | |
| 100 | | Return code for BAUD RATE in header | |
| 110 | | Return code while writing to flag bit | |
| 111 | | Return code while writing to outputs | |
| 112 | | Return code while writing to inputs | |
| 113 | | Return code while writing to flag | |
| 114 | | Return code while writing to timer | |
| 115 | | Return code while writing to counter | |
| 116 | | Return code while writing to data block | |
| 117 | | Return code while writing to output bit | |
| 118 | | Return code while writing to input bit | |
| 119 | | Return code while writing to data block bit | |
| 120 | | Return code while reading from flag bit | |
| 121 | | Return code while reading from output | |
| 122 | | Return code while reading from input | |
| 123 | | Return code while reading from flag | |
| 124 | | Return code while reading from timer | |
| 125 | | Return code while reading from counter | |
| 126 | | Return code while reading from data block | |
| Subcodes for codes 60 to 126 | | | |
| | 000 | No error found | |
| | 257 | Communication connection not available | |
| | 266 | No acknowledgment/acknowledgment delay | |
| | 268 | Data do not exist or are locked | |
| | 512 | Unknown error | |
| | 513 | Wrong interface specified | |
| | 514 | Too many interfaces | |
| | 515 | Toolbox already initialized | |
| | 516 | Toolbox already initialized with another connection | |
| | 517 | Toolbox not initialized | |
| | 518 | Handle can not be set | |
| | 519 | Data segment not locked | |

Table 5-520 Error messages for Siemens S7 MPI (HMI adapter)

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| | 521 | Data field not correct | |
| | 770 | Block too small | |
| | 771 | Block limits exceeded | |
| | 787 | Wrong MPI transmission rate selected | |
| | 788 | Highest MPI address wrong | |
| | 789 | Address already exists | |
| | 794 | Not connected with MPI network | |
| | 795 | No information | |
| | 800 | Hardware error | |
| | 897 | Hardware error | |
| | 16385 | Communication connection unknown | |
| | 16386 | Communication connection not available | |
| | 16387 | MPI communication in progress | |
| | 16388 | MPI connection aborted | |
| | 2048 | Toolbox in use | |
| | 32769 | Not permitted in this operating mode | |
| | 33025 | Hardware error | |
| | 33027 | Access to object not permitted | |
| | 33028 | Context not supported | |
| | 33029 | Address invalid | |
| | 33030 | Data type not supported | |
| | 33031 | Data type not consistent | |
| | 33034 | Object does not exist | |
| | 33537 | Not enough memory in CPU | |
| | 33796 | Fatal error | |
| | 34048 | Wrong PDU size | |
| | 34562 | Address invalid | |
| | 53761 | Syntax error: block name | |
| | 53762 | Syntax error: function parameter | |
| | 53763 | Syntax error: block type | |
| | 53764 | No linked data block in CPU | |
| | 53765 | Object 1 already exists | |
| | 53766 | Object 2 already exists | |
| | 53767 | Data block in EPROM | |
| | 53769 | Block does not exist | |

Table 5-520 Error messages for Siemens S7 MPI (HMI adapter)

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| | 53774 | Block not available | |
| | 53776 | Block number too large | |
| | 53825 | Protection level too low | |
| | 54278 | Information does not exist | |
| | 55298 | This job does not exist | |
| | 61185 | Wrong ID2, cyclic handle of job | |
| | 65487 | API function called up with invalid parameter | |
| | 65501 | Illegal baud rate | |
| | 6502 | Range error, violation of asynchronous character range | |
| | 65503 | Parity error | |
| | 65504 | Overrun, too many characters received | |
| | 65505 | Transport error | Wrong parity |
| | 65506 | Telegram was not acknowledged | |
| | 65507 | Collision with remote partner of higher priority | |
| | 65508 | Device in receive mode | |
| | 65509 | Number of maximum connection requests exceeded | |
| | 65510 | Function is not supported in current operating mode | |
| | 65511 | Operating mode is not supported | |
| | 65512 | Interface handle invalid | |
| | 65513 | Hardware does not support this function | |
| | 65514 | Interface table full | |
| | 65515 | Cycle time exceeded during write process | |
| | 65516 | Value out of valid range | |
| | 65517 | Interface not open | |
| | 65518 | Buffer can not be assigned | |
| | 65519 | Element not installed | |
| | 6520 | Element already open | |
| | 65533 | Unknown function | |
| | 65534 | Unknown error | |
| | 65535 | Acknowledgment delay | RS232 interface defective |

## 5.32 Siemens S7 PPI

The Siemens S7 PPI protocol provides random read and write access to almost all data of the controller.

This protocol supports a connection to the Siemens S7-200 controller.

You have the option of establishing either a point-to-point connection (1:1) or a multipoint connection (1:N). In this case, the operating device is the master and the controller is the slave.

The RS485 interface is used to connect the TesiMod operating device to the controller(s).

Make sure to follow the guidelines for setting up a PPI system!

### 5.32.1 Data Types

Direct access is possible to the following data types.

Table 5-521 Siemens S7 PPI data types

| Type | Mnemonic | Address | Access |
|---|---|---|---|
| Input | E | Bit | Read/Write |
| | EB | Byte | |
| | EW | Word | |
| | ED | Double word | |
| Output | A | Bit | |
| | AB | Byte | |
| | AW | Word | |
| | AD | Double Word | |
| Flag | M | Bit | |
| | MB | Byte | |
| | MW | Word | |
| | MD | Double Word | |
| Variable | V | Bit | |
| | VB | Byte | |
| | VW | Word | |
| | VD | Double Word | |
| Timer | T | Actual Value | Read-only |
| Timer Status | TS | Status | Read-only |
| Counter | Z | Actual Value | Read-only |
| Counter Status | ZS | Status | Read-only |
| Analog Input | AEW | Word | Read-only |

## 5.32.2 Programming

### 5.32.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.32.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-522 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.32.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-523 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.32.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-524 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.32.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-525 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.32.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-526 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.32.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-527 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 100 ms |

#### 5.32.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-528 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1 s to 255 s | 5 s |

#### 5.32.2.1.8 Station Number of the Terminal

This parameter specifies the station address of the TesiMod operating device.

Table 5-529 Station number of the terminal

| Configurable Values | Default Value |
|---|---|
| 0 to 127 | 0 |

The station number of the TesiMod operating device can be changed during operation. This requires that you set up the system variable **ComSlaveNr** in a mask. After changing the value of the system variable on the operating device, reinitialize the operating device. You can do this by:

– powering the device down and up again or
– using the system variable **Boot**.

Change the value of the system variable **Boot** to "1" to reinitialize the operating device immediately. The value of the system variable **ComSlaveNr** is overwritten when the project is downloaded again.

The communication with the controller is terminated when you enter a value >127 for the system variable **ComSlaveNr**. This is necessary if you wish to use a programming device (also master) to access the PPI interface of the controller.

#### 5.32.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

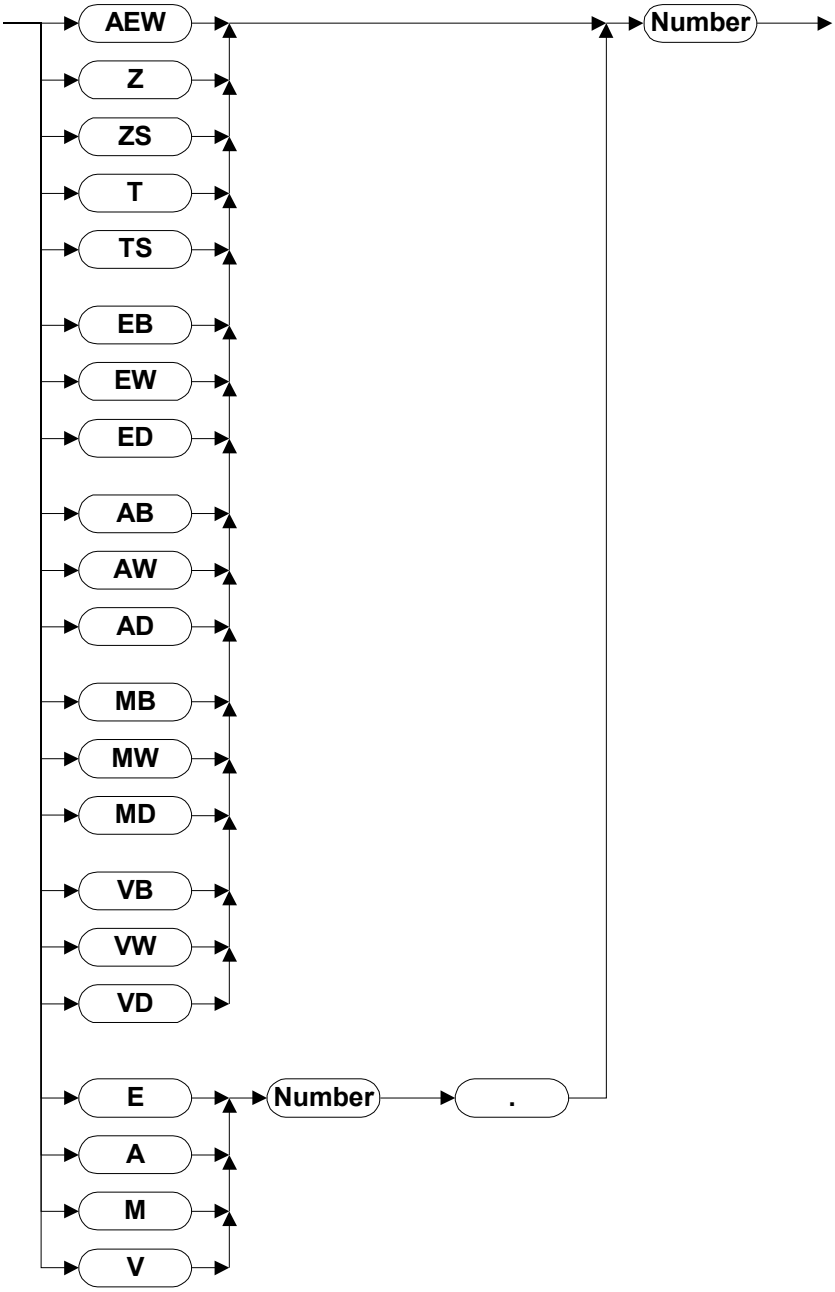



Figure 5-92 Syntax diagram

#### 5.32.2.3 System Parameters

##### 5.32.2.3.1 Poll Area

For the address of the poll area, you must specify a variable word address.

Table 5-530 Word-oriented poll area for Siemens S7 PPI

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | VW 20 | Write Coordination Byte | Reserved |
| Word Address + 2 | VW 22 | Message Channel High-Byte | Message Channel Low-Byte |
| Word Address + 4 | VW 24 | Function Key LEDs 1 to 4 | Function Key LEDs 5 to 8 |
| Word Address + 6 | VW 26 | Function Key LEDs 9 to 12 | Function Key LEDs 13 to 16 |
| Word Address + 8 | VW 28 | Function Key LEDs 17 to 20 | Function Key LEDs 21 to 24 |
| Word Address + 10 | VW 30 | Function Key LEDs 25 to 28 | Function Key LEDs 29 to 32 |

##### 5.32.2.3.2 Status Messages

For the address of the parallel message system, you must specify a variable word address.

Table 5-531 Parallel message system for Siemens S7 PPI

| Word Address | Reference | High Byte | Low Byte |
|---|---|---|---|
| Word Address + 0 | VW 10 | Messages 9 to 15 | Messages 0 to 8 |
| Word Address + 1 | VW 12 | Messages 24 to 31 | Messages 16 to 23 |
| Word Address + 2 | VW 14 | Messages 40 to 47 | Messages 32 to 39 |

### 5.32.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.32.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-532 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.32.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-533 Pin assignment X2 RS485

| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

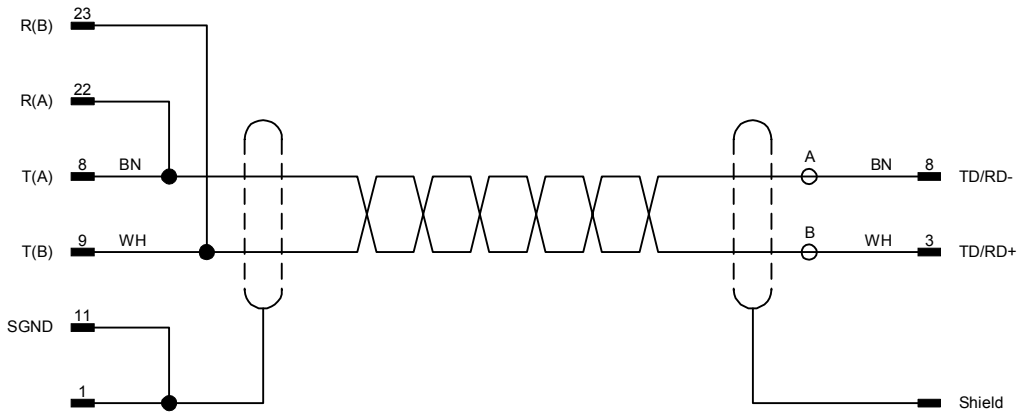
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.32.3.3 Cable X3 SER1 RS485 - Siemens S7 PPI

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Siemens PLC
S7-200




D-SUB
male connector
25 pin

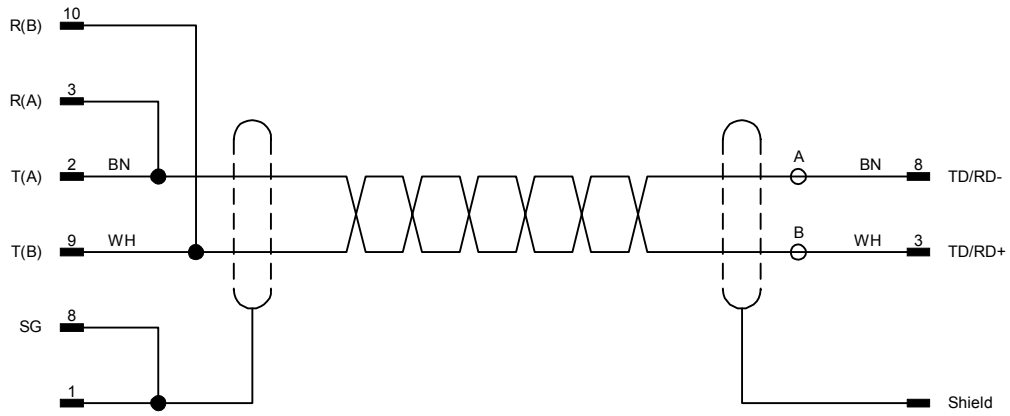
D-SUB
male connector
9 pin

#### 5.32.3.4 Cable X2 RS485 - Siemens S7 PPI

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Siemens PLC
S7-200

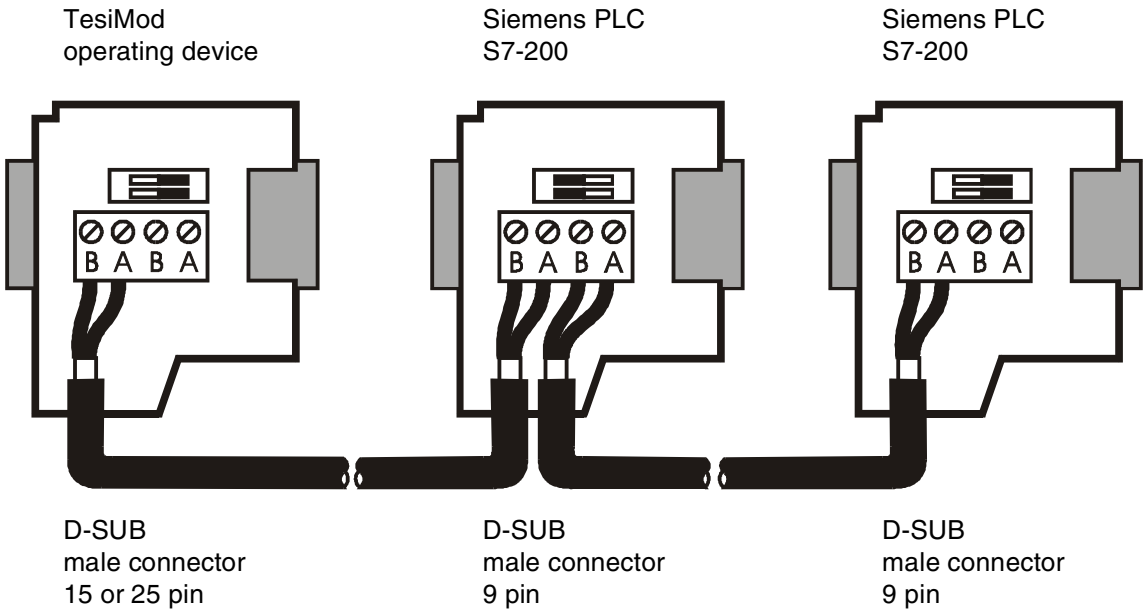



D-SUB
male connector
15 pin

D-SUB
male connector
9 pin

### 5.32.3.5 Cable for Siemens S7 PPI Bus Connection

The wiring diagram below shows an example of a setup with Siemens S7 PPI connectors.




**Terminating resistors**

The connectors are fitted with terminating resistors which you can switch on or off. If you are using your own cable assembly, you must place terminating resistors at the cable ends as shown in the figure below.

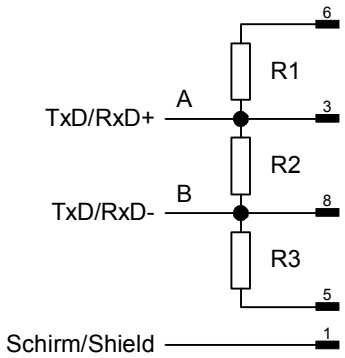



Figure 5-93 Termination of cable ends for Siemens S7 PPI

For further information on the "Siemens S7-200 bus connection“, refer to the Siemens manual on how to setup a S7-200.

### 5.32.4 Error Messages

Error messages are displayed on the operating device along with a code and sub-code. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-534 Error messages for Siemens S7-PPI

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | |
| 2 | | Packets out of sequence | |
| 3 | | Error in protocol frame | |
| 4 | | Waiting time elapsed (timeout) | Connection broken. |
| 5 | | CRC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 40 | | System variable error | Undefined system variable |
| Communication error on hardware level | | | |
| 50 | 1 | No response on check request | |
| | 2 | No acknowledgment on data request | |
| | 3 | No data response | |
| Communication error on protocol level | | | |
| 60 | 10 | Wrong response checksum | |
| | 11 | Wrong response telegram length | |
| Communication error on protocol level - wrong telegram sequence | | | |
| 61 | 20 | Wrong response telegram | |
| Communication error on timeout level | | | |
| 70 | 1 | No response on check request | |
| | 2 | No acknowledgment on data request | |
| | 3 | No data response | |

Table 5-534 Error messages for Siemens S7-PPI

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| Error in response in expected 0xE5 | | | |
| 80 | 3 | Error from controller 03 = parameter error | |
| | 5 | Error from controller 05 = illegal address | |
| | 6 | Error from controller 06 = data type not compatible with operand | |
| | 10 | Error from controller 10 = string length not compatible with data length | |
| Error in response to read request | | | |
| 81 | 3 | Error from controller 03 = parameter error | |
| | 5 | Error from controller 05 = illegal address | |
| | 6 | Error from controller 06 = data type not compatible with operand | |
| | 10 | Error from controller 10 = string length not compatible with data length | |
| Error in response to write request | | | |
| 82 | 3 | Error from controller 03 = parameter error | |
| | 5 | Error from controller 05 = illegal address | |
| | 6 | Error from controller 06 = data type not compatible with operand | |
| | 10 | Error from controller 10 = string length not compatible with data length | |

## 5.33 Sinec L1 Master

The Sinec L1 Master protocol allows you:

– random read and write access to all controller data
– bit-access to all byte-oriented data types
– byte access to all data words in a data block.

The size of the address area depends on the controller being used.

The protocol supports a connection to the PG interface of the following Simatic S5 types.

Table 5-535 Simatic S5 types with a PG interface

| Controller Type | CPU |
|---|---|
| SIMATIC S5-95U | 8-bit CPU |
| SIMATIC S5-100U | CPU103 / 8-bit CPU |
| SIMATIC S5-115U | |

If the communication processor CP530 is used, the protocol supports a connection to the following Simatic S5 types.

– SIMATIC S5-115U
– SIMATIC S5-135U
– SIMATIC S5-155U

### 5.33.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the controller's CPU.

Table 5-536 Data types - Siemens L1 master

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | E | Bit Access (Read Only) |
| Input Byte | EB | Byte Access (Read Only) |
| Input Word | EW | Word Access (Read Only) |
| Input Double-Word | ED | Double-Word Access (Read Only) |
| Output Bit | A | Bit Access |
| Output Byte | AB | Byte Access |
| Output Word | AW | Word Access |
| Output Double-Word | AD | Double-Word Access |
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Flag Double-Word | MD | Double-Word Access |
| Data Word | DW | Word Access |

Table 5-536 Data types - Siemens L1 master

| Type | Mnemonic | Access |
|---|---|---|
| Data-Word Left (High) | DL | Word Access |
| Data-Word Right (Low) | DR | Word Access |
| Data Double-Word | DD | Double-Word Access |
| Timer | T | Word Access (Read Only) |
| Counter | Z | Word Access (Read Only) |

**Counter:**

For counters, a distinction is made between variables which have been assigned a counter address and variables which have been assigned another PLC address.

When accessing counter addresses, the count value is interpreted in binary format, the control bits of the counter are masked out.

Therefore, to avoid control bits from being erased, counter addresses should be accessed in **read-mode only**.

The count value is interpreted in BCD-code. This allows the transfer of this value within the PLC program to the counter by means of the accumulator. This function should be used for indirect write-operations of count starting values since the values are available in a Siemens compliant format.

**Timer:**

Timer values consist of a time value and a time base.

The operating device reads the 2-byte variable and converts it into an imaginary unsigned 4-byte variable which represents the time value in reference to the base 0.01 seconds. The operating device makes a distinction between accesses to a timer address and accesses to other controller addresses.

When accessing timer addresses, the operating device interpretes the time value in binary format; when accessing another controller address, the operating device interpretes the time value in BCD code.

Therefore, to avoid the timer's control bits from being erased, timer addresses should be accessed in read-mode only.

Accesses to other addresses should be used for indirect write-operations of timer starting values since the values are prepared in the Siemens compliant format.

Before writing a timer value to the PLC, the operating device converts the unsigned 4-byte variable back into a 2-byte variable with a time value for the smallest possible time base. In addition, the operating device makes a distinction between writing the timer value to a timer address and writing it to another PLC address.

## 5.33.2 Programming

### 5.33.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.33.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-537 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.33.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-538 Parity

| Configurable Values | Default Value |
|---|---|
| None | |
| Even | X |
| Odd | |

#### 5.33.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-539 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.33.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-540 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.33.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-541 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | X |
| 1.5 | |
| 2 | |

#### 5.33.2.1.6 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-542 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 50 ms to 65535 ms | 500 ms |

#### 5.33.2.1.7 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-543 Delay until connection set-Up

| Configurable Values | Default Value |
|---|---|
| 0 ms to 65535 ms | 10000 ms |

#### 5.33.2.1.8 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

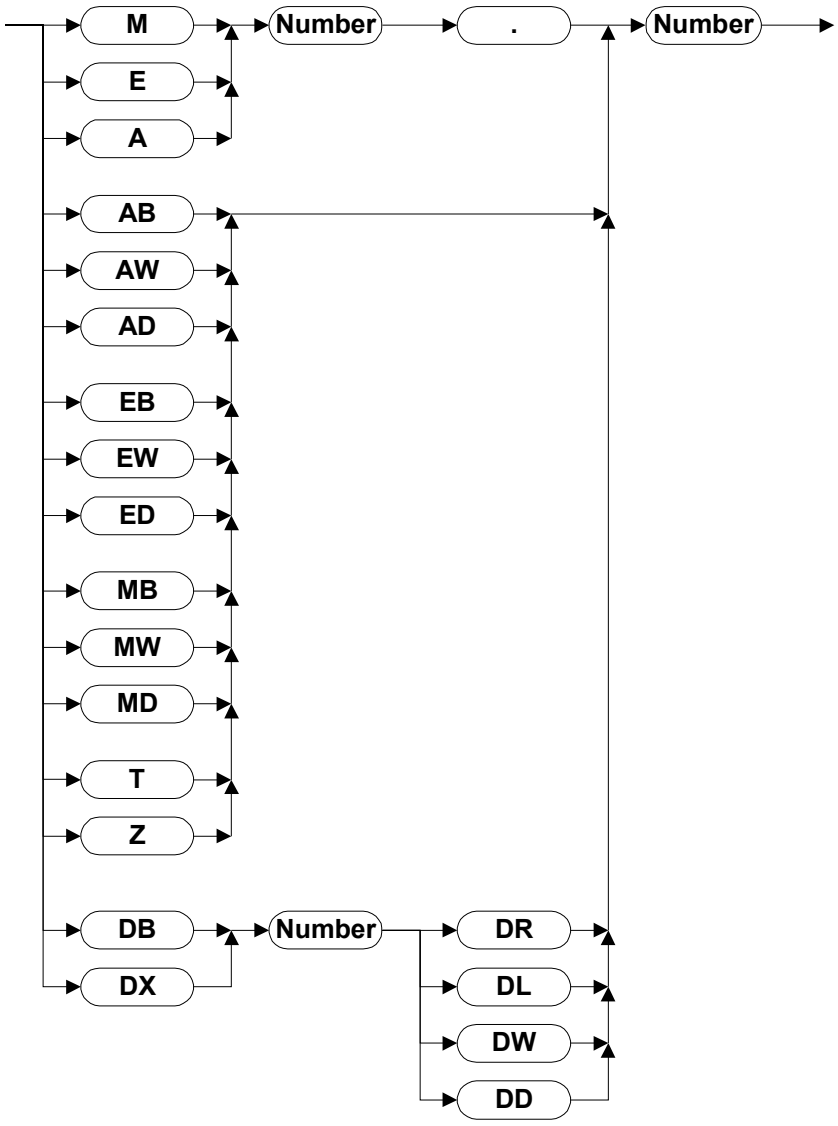



Figure 5-94 Syntax diagram

#### 5.33.2.1.9 Slave Number

With the connection Sinec L1 Master, the controller acts as a slave. The controller or the communication processor CP530, respectively, is assigned a slave number which is added to the address. The number in TSwin must always be the same as the number of the destination controller.

## 5.33.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

### 5.33.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-544 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 10 | T+ | Transmitted Data, Positive Polarity |
| 12 | S1+ | Power Source 1, Positive Polarity |
| 13 | R+ | Received Data, Positive Polarity |
| 14 | R- | Received Data, Negative Polarity |
| 16 | S2+ | Power Source 2, Positive Polarity |
| 19 | T- | Transmitted Data, Negative Polarity |
| 21 | S1- | Current Sink 1, Negative Polarity |
| 24 | S2- | Current Sink 2, Negative Polarity |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

### 5.33.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-545 Pin assignment TTY / 20 mA, active

| Pin | Designation | Function |
|---|---|---|
| 1 | Shield | Shielding |
| 2 | T+ | Transmitted Data, Positive Polarity |
| 3 | S1+ | Power Source 1, Positive Polarity |
| 4 | R+ | Received Data, Positive Polarity |
| 5 | S2+ | Power Source 2, Positive Polarity |
| 6 | T- | Transmitted Data, Negative Polarity |
| 7 | S1- | Current Sink 1, Negative Polarity |
| 8 | R- | Received Data, Negative Polarity |
| 9 | S2- | Current Sink 2, Negative Polarity |

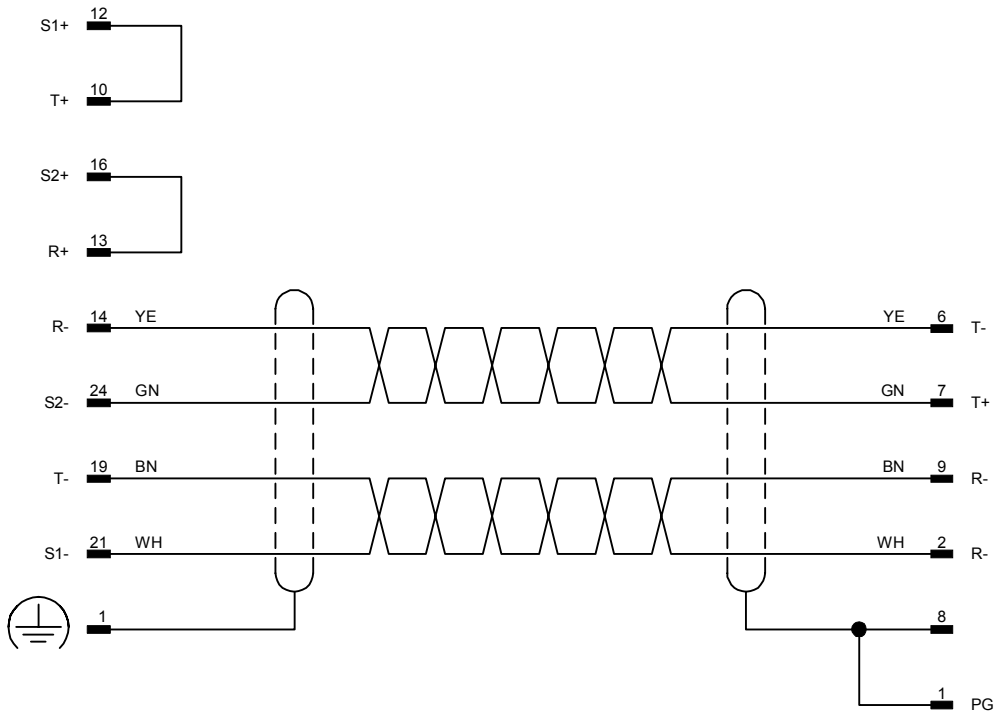
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.33.3.3 Cable X3 SER1 TTY / 20 mA - Sinec L1

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device
Transmitter active
Receiver active

Siemens
Simatic S5
Transmitter passive
Receiver active




D-SUB
male connector
25 pin

D-SUB
male connector
15 pin

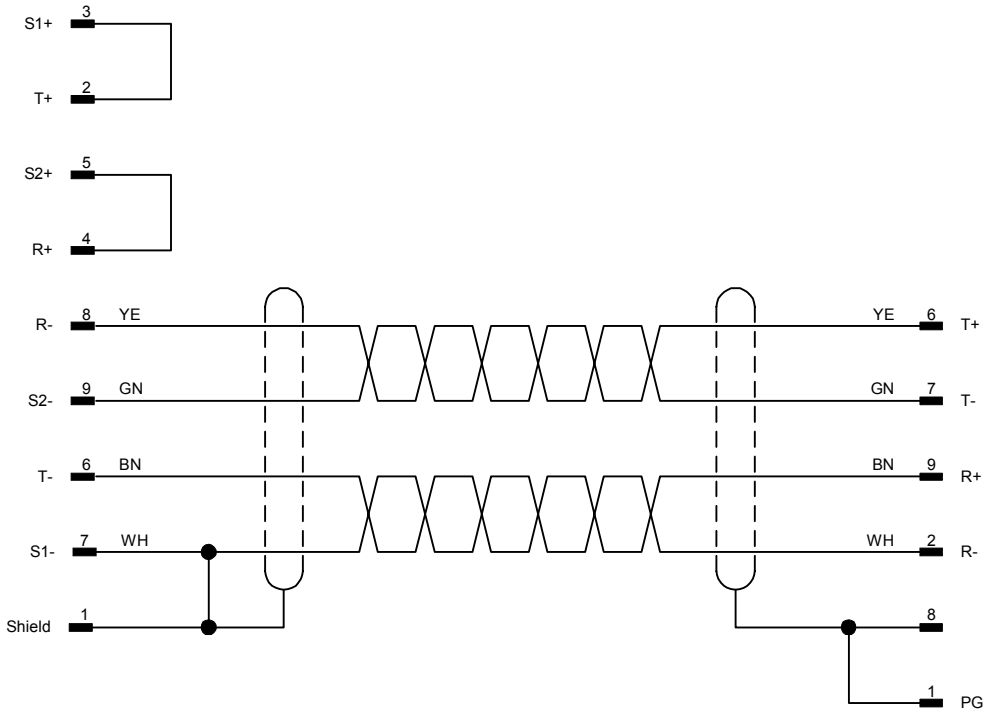
Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

#### 5.33.3.4 Cable X2 TTY / 20 mA - Sinec L1

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device
Transmitter active
Receiver active

Siemens
Simatic S5
Transmitter passive
Receiver active




D-SUB
male connector
9 pin

D-SUB
male connector
15 pin

Both ends of the shield are connected to the metallic housing and pin 1 of the connector.

### 5.33.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-546 Error messages for Sinec L1 Master

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong slave address or connecting cable not plugged-in properly |
| 2 | | Packets out of sequence | Wrong interface parameters specified |
| 4 | | Waiting time elapsed (timeout) | Connection broken |
| 5 | | CRC or BCC error | |
| 6 | | Wrong parity | |
| 16 | | Receive buffer overrun | |
| 17 | | NAK from controller despite repetitions | Controller is in STOP state or controller has detected a parity error |
| 40 | | System variable error | Undefined system variable orinvalid slave number 255 |
| 51 | | The maximum number of 100 poll attempts has been exceeded. There was no response to read/write request. | Controller is in STOP state or TesiMod function block is not being called or controller overloaded |
| 52 | | Error during addressing | Undetected transmission error despite parity check |
| 53 | | Error in internode communication request | The Sinec L1 interface is not accessed exclusively by the TesiMod function block. Error in application program. |

Table 5-546 Error messages for Sinec L1 Master

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 54 | | Error during data transfer | The length of the data received exceeded 64 bytes. |
| 55 | | The destination address for the telegram from the controller to the operating device is not 0. | The Sinec L1 interface is not accessed exclusively by the TesiMod function block. Error in application program. |
| 56 | | Wrong data type | The TesiMod function block has been reduced in size to save memory space and no longer supports all data types or attempt to write-access inputs, counters or timersor project in Flash memory contains errors |

### 5.33.5 Applications

For a connection to the Siemens Simatic S5 controllers, you need to set up function blocks. The function blocks are copied into subdirectories during the installation of TSwin.

Table 5-547 Directories for the function blocks

| Simatic Type | FB Number | Directory |
|---|---|---|
| S5 95U | FB200FB201FB202FB203 | C:\Program Files\TSwin\FBs\L1\AG95U |
| S5 115U PG | FB202FB203 | C:\Program Files\TSwin\FBs\L1\AG115U |
| | FB200FB201 | C:\Program Files\TSwin\FBs\L1\AG115U\PG |
| S5 115U CP530 | FB202FB203 | C:\Program Files\TSwin\FBs\L1\AG115U |
| | FB200FB201 | C:\Program Files\TSwin\FBs\L1\AG115U\CP |

#### 5.33.5.1 Connection to Simatic S5 95U and S5 115U

For a connection to the Siemens Simatic S5 95U/115U, you must carry out the following steps:

– Transfer the function blocks FB200, FB201, FB202 and FB203 to the controller.
– Create the data block L1DB in the RAM of the controller with a size of at least 77 data words.

Make sure you create the data block before one of the function blocks mentioned above is called for the first time !

– Call the FB200 from the startup blocks OB21 and OB22.
– Call the FB201 from the OB1. If required, the FB201 calls the FB202 or FB203.

The function blocks FB202 and FB203 use the flag words MW252 and MW254 as scratch flags. Therefore, if you wish to retain the information contained in these flags, you need to make a back up of their contents before the function blocks are called.

##### 5.33.5.1.1 Data Block L1DB

Since the operating device is capable of handling all read and write accesses to the data of the controller by means of the function blocks, the L1DB just needs to be used to transfer the status data area.

An area comprising 6 words (from DW70 to DW75) has been reserved in the L1DB for this purpose. This data area can be used by the controller to actively influence the operating device. Whenever the value 1 is written into the DL69, the entire contents of this data area is transferred to the operating device. After the transfer has successfully completed, the DL69 is automatically reset to 0. The DL69 is therefore a coordination byte for transferring the status data. And since the DL69 can only be reset to 0 if the communication connection is still active, you can also use the DL69 for connection monitoring.

For the timeout period, choose a value greater than 1 second.

All other data (except DW70 to DW75) must NOT be accessed by the application software!

##### 5.33.5.1.2 Function Block FB200 (Initialization)

The function block FB200 initializes the system data area of the controller with the parameters required for a Sinec L1 based communication.

Call the FB200 only once from the startup blocks OB21 and OB22. When the FB200 is called, the number of the data block L1DB is transferred as a parameter.

Make sure you create the data block L1DB before the FB200 is called the first time !

The FB200 initializes the L1DB and then defines the following parameters.

Table 5-548 Parameters in FB200

| Parameter | Value |
|---|---|
| PG number | 0 |
| Slave number | 1 |
| Receive Coord. Byte | DW1 in L1DB |

Table 5-548 Parameters in FB200

| Parameter | Value |
|---|---|
| Write Coord. Byte | DW0 in L1DB |
| Receive box | DW36 to DW68 in L1DB |
| Send box | DW2 to DW34 in L1DB |

#### 5.33.5.1.3 Function Block FB201 (Communication)

The function block FB201 handles the entire data traffic between the TesiMod operating device and the controller.

Call the FB201 cyclically from OB1. When the FB201 is called, you transfer the number of the data block L1DB as a parameter.

First of all, the FB201 checks whether a read or write request has been received from the operating device and if so, carries it out.For this purpose, the FB201 calls the FB202 (read) or FB203 (write).

If no request has been received from the operating device, the FB201 checks whether the status data area needs to be transferred to the operating device and carries this process out, if required.

#### 5.33.5.2 Connection to the Simatic S5 135U with CP530

For a connection to the Siemens Simatic S5 135U with the communication processor CP530, you must carry out the following steps:

- Specify the slave number 1 for the communication processor. If you intend to use another number, make sure to use the corresponding slave number in TSwin when addressing the variable.
- Transfer the function blocks FB200, FB201, FB202 and FB203 to the controller.
- Create the data block L1DB in the RAM of the controller with a size of at least 93 data words. The data block must be assigned the number 15.

Make sure you create the data block before one of the function blocks mentioned above is called for the first time !

- Call the FB200 from the startup blocks OB20, OB21 and OB22.
- Call the FB201 from the OB1. If required, the FB201 calls the FB202 or FB203.

The function blocks FB202 and FB203 use the flag words MW248 to MW254 as scratch flags. Therefore, if you wish to retain the information contained in these flags, you need to make a back up of their contents before the function blocks are called.

##### 5.33.5.2.1 Data Block L1DB

Create the data block L1DB with the number 15. The function blocks FB202 and FB203 always reference this block number.

If this number has already been used elsewhere, you can also use any other number. In this event, make sure to adjust the references in the function blocks accordingly.

The operating device handles all read and write access to the data of the controller on its own using the function blocks. The only task remaining for the L1DB is the transfer of the status data area. ???

An area comprising 6 words (from DW70 to DW75) has been reserved in the L1DB for this purpose. This data area can be used by the controller to actively influence the operating device. Whenever the value 80H is written into the DL69, the entire contents of this data area is transferred to the operating device. After the transfer has successfully completed, the DL69 is automatically reset to 0. The DL69 is therefore a coordination byte for transferring the status data. And since the DL69 can only be reset to 0 if the communication connection is still active, you can also use the DL69 for connection monitoring.

For the timeout period, choose a value greater than 1 second.

All other data (except DW70 to DW75) must NOT be accessed by the application software!

##### 5.33.5.2.2 Function Block FB200 (Initialization)

The function block FB200 initializes the system data area of the controller with the parameters required for a Sinec L1 based communication. In addition, the function block synchronizes the communication processor CP530.

The error output (FEHL) is set if an error occurs during synchronization with the communication processor CP530.

Call the FB200 only once from the startup blocks OB20, OB21 and OB22. When the FB200 is called, the number of the data block L1DB (SSNR) and the number of the interface to the CP530 is transferred as a parameter.

Make sure you create the data block L1DB before the FB200 is called the first time !

#### 5.33.5.2.3 Function Block FB201 (Communication)

The function block FB201 handles the entire data traffic between the TesiMod operating device and the controller.

Call the FB201 cyclically from OB1. When the FB201 is called, you transfer the number of the data block L1DB as a parameter.

First of all, the FB201 checks whether a read or write request has been received from the operating device and if so, carries it out. For this purpose, the FB201 calls the FB202 (read) or FB203 (write).

If no request has been received from the operating device, the FB201 checks whether the status data area needs to be transferred to the operating device and carries this process out, if required.

## 5.34 SUCOM1 PS306/316

The SUCOM1 PS306/316 protocol provides you

– random read and write access to all data of the controller
– bit access to all data types

Before individual bits can be accessed for a write operation, a read access to the addressed word is performed. Then the write access to the bit can be carried out. For this type of access, you must therefore ensure that the operating device and the controller do not modify individual bits of the same word.

The size of the address area depends on the controller being used.

This protocol supports a connection to the following Moeller controllers.

Table 5-549 Supported controller types

| Controller Type | Interface |
|---|---|
| PS306 | PG |
| PS316 | PG |
| PS416 | SBI |

### 5.34.1 Data Types

Direct access is possible to the following data types.

The size of the individual data areas depends on the CPU.

Table 5-550 SUCOM1 PS306/316 data types

| Type | Mnemonic | Access |
|---|---|---|
| Input Bit | I | Bit Access (Read-only) |
| Input Byte | IB | Byte Access (Read-only) |
| Input Word | IW | Word Access (Read-only) |
| Output Bit | Q | Bit Access |
| Output Byte | QB | Byte Access |
| Output Word | QW | Word Access |
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Process Status Word | PS | Word Access |
| Diagnostics Word | DS | Word Access |
| Diagnostics Counter | DZ | Word Access (Read-only) |

## 5.34.2 Programming

### 5.34.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.34.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-551 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.34.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-552 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.34.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-553 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.34.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-554 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.34.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-555 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.34.2.1.6 Swap LED Output

This parameter specifies whether the bytes responsible for controlling the LEDs in the polling area are to be swapped (byte swapping).

Table 5-556 Swap LED output

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.34.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

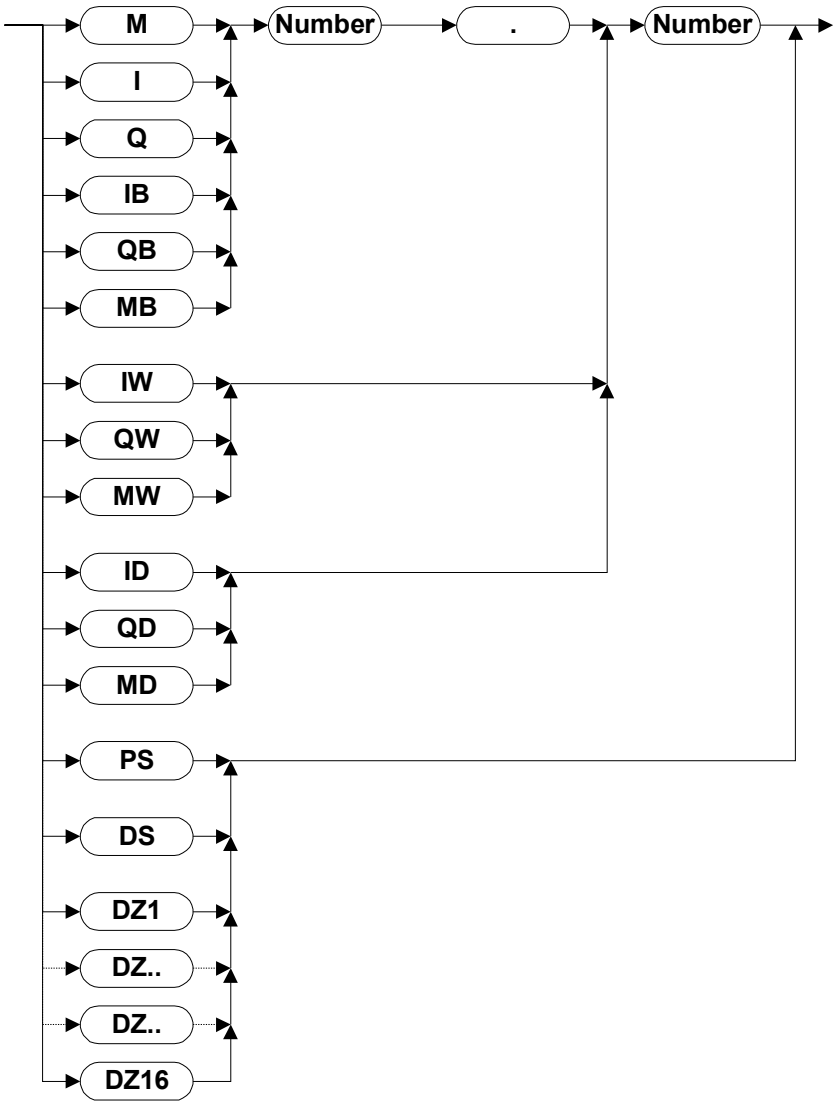



Figure 5-95 Syntax diagram for SUCOM1 PS306/316

### 5.34.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

The PS306/316 interface is only a half-duplex interface.

#### 5.34.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-557 Pin assignment RS485

| Pin | Designation | Function |
|---|---|---|
| 8 | T(A) | Transmitted Data (-) |
| 9 | T(B) | Transmitted Data (+) |
| 11 | SGND | Signal Ground |
| 22 | R(A) | Received Data (-) |
| 23 | R(B) | Received Data (+) |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.34.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-558 Pin assignment X2 RS485

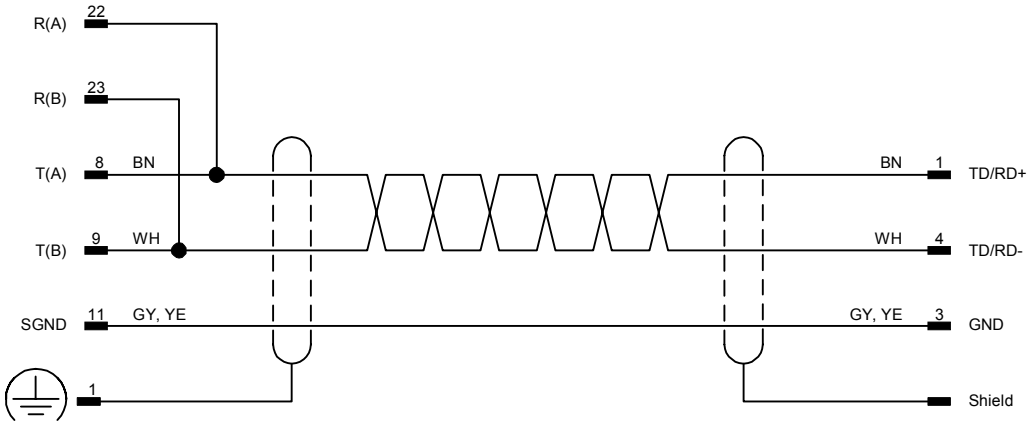
| Pin | Designation | Function |
|---|---|---|
| 1 | Schirm | Shielding |
| 2 | T(A) | Transmitted Data (-) |
| 3 | R(A) | Received Data (-) |
| 4 | RTS(A) | Request to Send (-) |
| 5 | CTS(A) | Clear to Send (-) |
| 6 | nc | Not Connected |
| 7 | nc | Not Connected |
| 8 | SG | Signal Ground |
| 9 | T(B) | Transmitted Data (+) |
| 10 | R(B) | Received Data (+) |
| 11 | RTS(B) | Request to Send (+) |
| 12 | CTS(B) | Clear to Send (+) |
| 13 | nc | Not Connected |
| 14 | nc | Not Connected |
| 15 | nc | Not Connected |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.34.3.3 Cable X3 SER1 RS485 - Moeller PS306

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device — Moeller PS306




D-SUB
male connector
25 pin

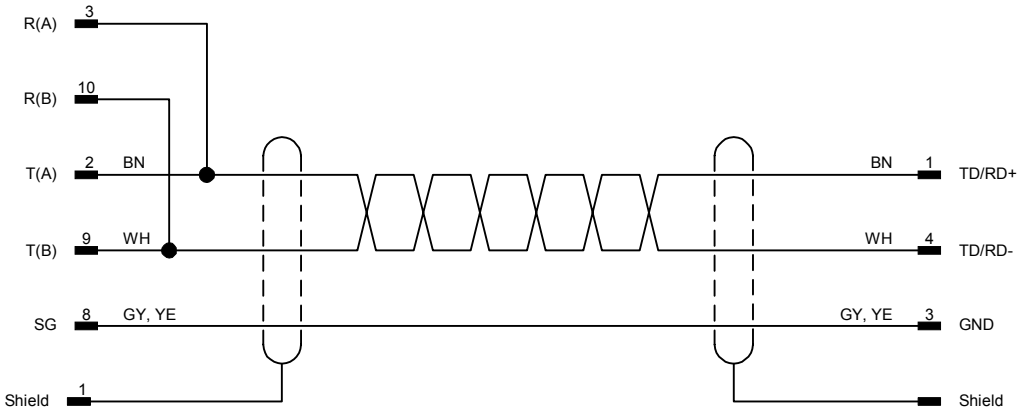
D-SUB
male connector
25 pin

Both ends of the shield are connected to the metallic housing.

#### 5.34.3.4 Cable X2 RS485 - Moeller PS306

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device — Moeller PS306




D-SUB
male connector
15 pin

D-SUB
male connector
25 pin

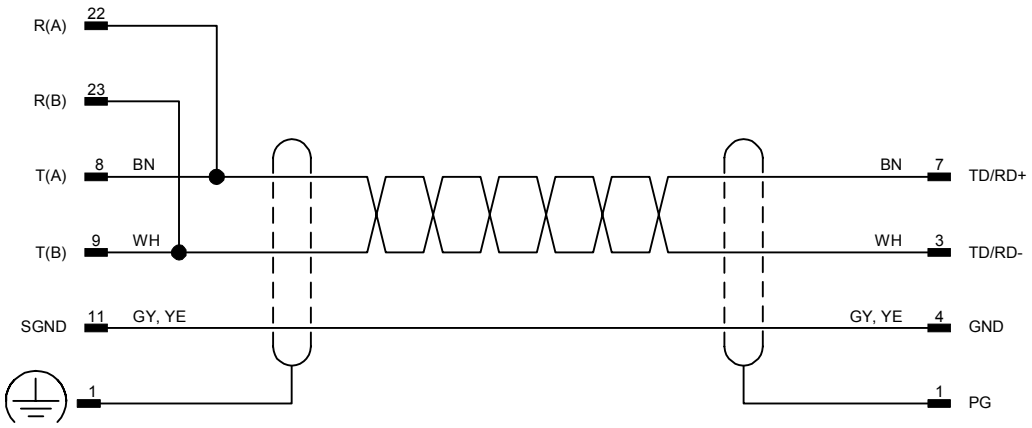
Both ends of the shield are connected to the metallic housing.

### 5.34.3.5 Cable X3 SER1 RS485 - Moeller PS316/PS416

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Moeller
PS316Moeller
PS416




D-SUBmale connector 25 pin

D-SUBmale connector 25 pin

Both ends of the shield are connected to the metallic housing.

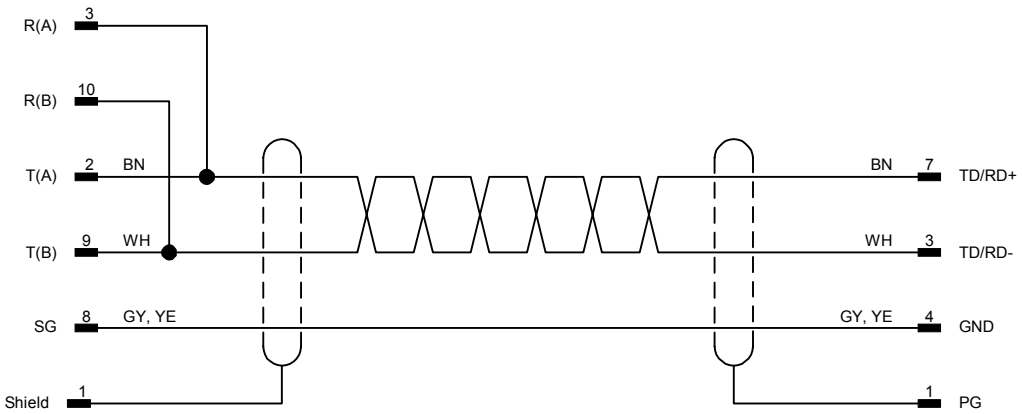
On the operating device, activate the termination of the interface.

#### 5.34.3.6 Cable X2 RS485 - Moeller PS316/PS416

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Moeller
PS316Moeller
PS416




D-SUBmale connector 15 pin

D-SUBmale connector 25 pin

Both ends of the shield are connected to the metallic housing.

On the operating device, activate the termination of the interface.

### 5.34.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-559 Error messages for SUCOM1 PS306/316

| Code | Subcode | Designation | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong slave address or connecting cable not plugged-in properly |
| 2 | | Packets out of sequence | |
| 3 | | Protocol framing error | |
| 4 | | Waiting time elapsed (timeout) | Connection broken |
| 5 | | CRC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 17 | | NAK from controller | |
| 40 | | System variable error | Undefined system variable |
| SUCOM1-specific error messages | | | |
| 50 | | Wrong acknowledgment during connection setup | |
| 51 | | No acknowledgment after data transmission | |
| 52 | | No response telegram | |
| 53 | | Incorrect number of data received | Check if the mask, in which the error occurred, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |

## 5.34.5 Applications

### 5.34.5.1 Connection to PS416

The CPU module ZB416-400 has a PRG and a SBI interface. The PRG interface is located at the top and the SBI interface is located at the bottom of the module.

A function block (included in the scope of delivery of the Moeller software S40) is required to be able to operate the SBI interface with the SUCOM-A protocol. You can also operate the SBI interface with the SUCOnet-K protocol. The SBI interface is of the RS485-type.

#### 5.34.5.1.1 Settings at the Controller

**Participant address**

It is not necessary to change the factory-set participant address (address 1). The DIP switch used to set the address is located on the upper board next to the slot for the memory card.

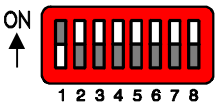



Figure 5-96 Setting for address 1

**Termination of SBI interface**

The physically first and last participant at a RS485 interface must be terminated with terminating resistors. The DIP switch for the terminating resistors is located on the lower board of the CPU module in the immediate vicinity of the SBI connector. The terminating resistors are factory-set to ON.

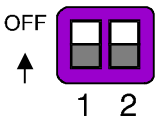



Figure 5-97 Setting for the terminating resistors

**Transparent mode**

A slide switch for mode selection is located on the lower board of the CPU module (in the immediate vicinity of the rack connector). Select the transparent mode for connections with the SUCOM-A protocol.

Figure 5-98 Setting for transparent mode

**Setting for PRG interface**

To transfer the PLC program to the controller, use either the original Moeller cable or the download cable for TesiMod operating devices with 9 pin D-SUB connector. On the PC-side, connect the cable to a free COM interface. On the PS416 connect it to the PRG interface. Select the RS232 setting for the PRG interface.

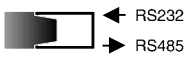



Figure 5-99 RS232 setting for PRG interface

#### 5.34.5.1.2 Sucosoft S40 Manager

Start the Sucosoft S40 Manager. The program opens displaying the following view.

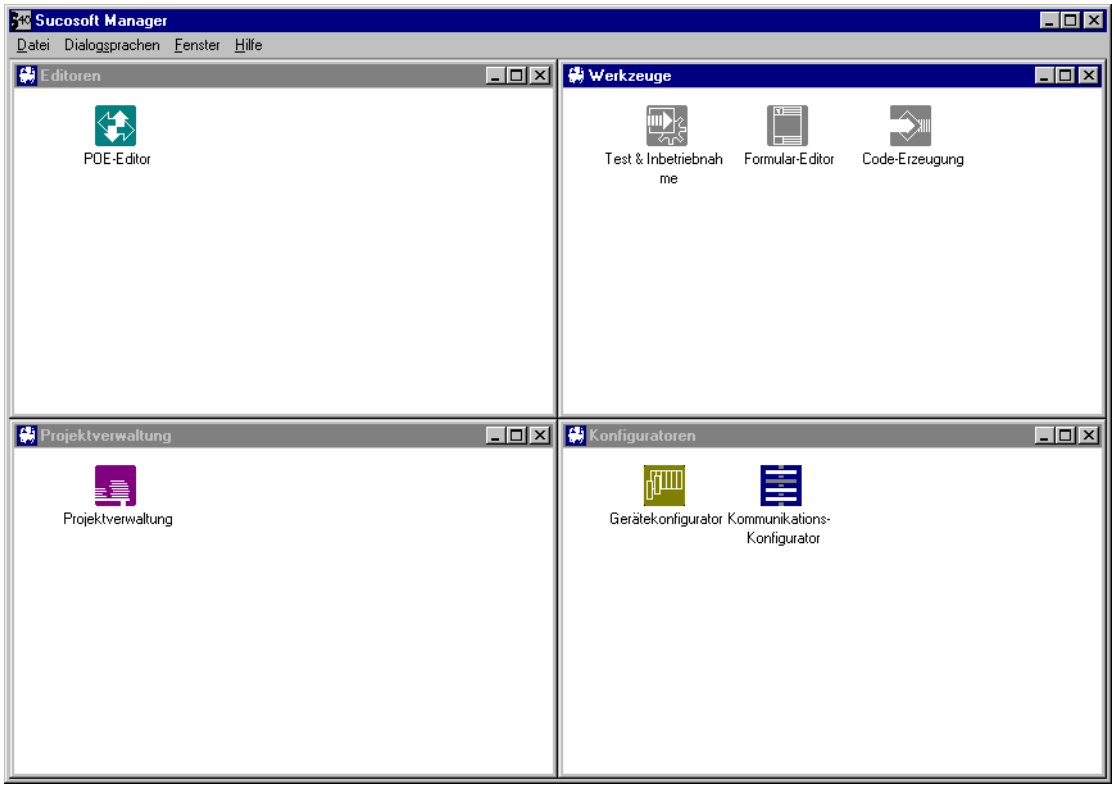



Figure 5-100 Sucosoft S40 Manager

**Project management**

1. Open the "Project Management" (Projektverwaltung) tab by double-clicking the corresponding icon in the "Project Management" (Projektverwaltung) window.
2. From the "Projects" (Projekt) menu, select the menu item "New" (Neu).
3. Enter a name for the new project into the dialog box.

All required subdirectories are created automatically. The result is displayed immediately.

**Device configurator**

Using the device configurator, select the components of the PS416 and set them up.

1. Start the device configurator by double-clicking the corresponding icon.

2. Specify the following settings.

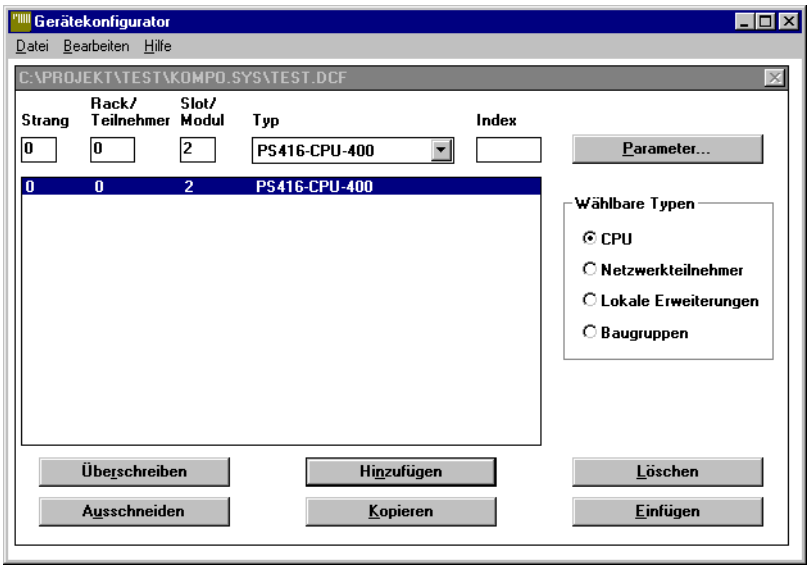



Figure 5-101 Selecting the CPU module

3. Click the "Parameters" button.
4. Select the following settings.

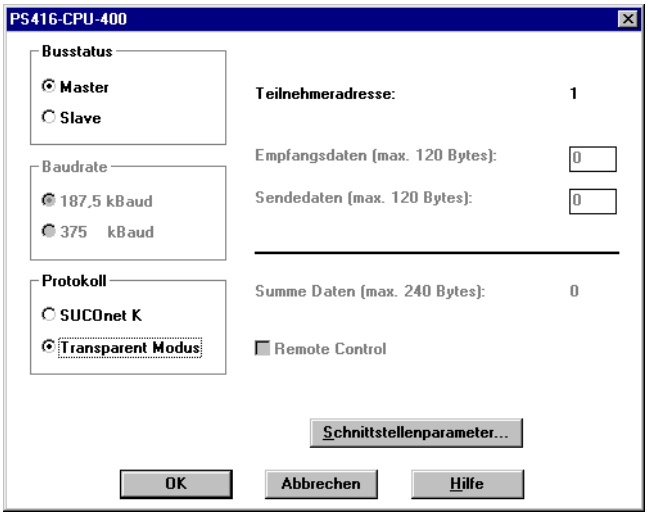



Figure 5-102 Parameter settings

5. Click the "Interface parameters" (Schnittstellenparameter) button.

6. Select the following settings.

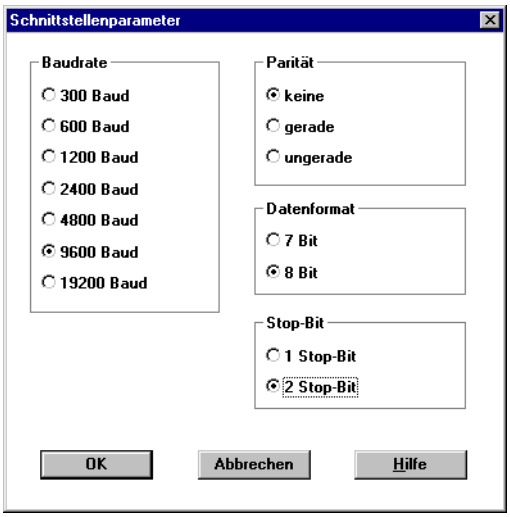



Figure 5-103 Interface parameter settings

7. Click the OK button.

You are returned to the "PS416-CPU-400" window.

8. Click the OK button.

You are returned to the "Device configurator" (Gerätekonfigurator) window.

9. Accept the settings by clicking the "Add" (Hinzufügen) button.
10. Configure all other modules of the controller.
11. Select "Save As" (Speichern unter) from the "File" (Datei) menu.
12. Enter a name for the file.
13. Click the OK button.
14. Close the device configurator.

**Communication configurator**

1. Start the communication configurator by double-clicking the corresponding icon.
2. Specify the following communication parameters.

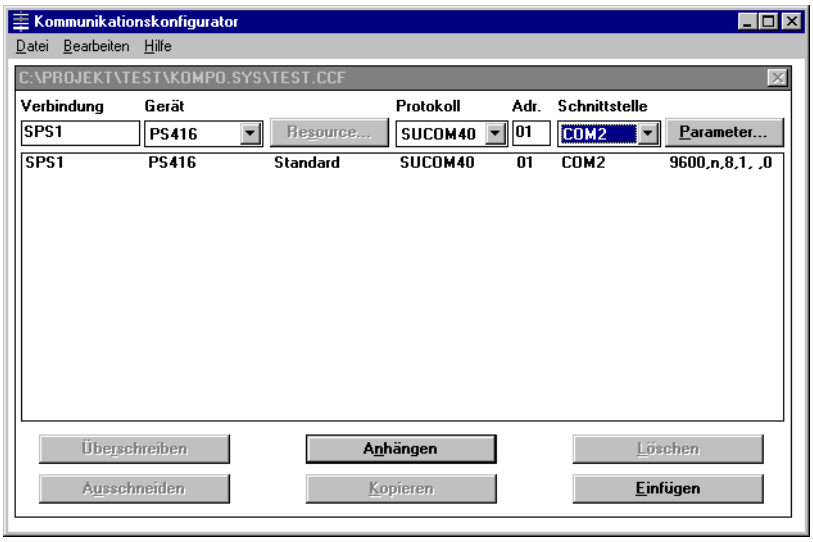



Figure 5-104 Communication configurator

3. Click the "Attach" (Anhängen) button.
4. Select "Save As" (Speichern unter) from the "File" (Datei) menu.
5. Enter a name for the file.
6. Click the OK button.
7. Close the communication configurator.

**POE Editor**

1. Start the POE editor by double-clicking the corresponding icon.

Once the device configuration has been loaded, an empty window appears.

2. Select "New" (Neu) from the "File" (Datei) menu.
3. Select "Program" (Programm) from the dialog window that appears.

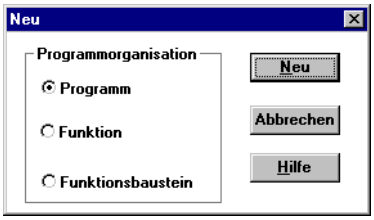



Figure 5-105 Creating a new POE program

4. Confirm the selection by clicking the "New" (Neu) button.

The "POE editor" window opens.

An editor (in this example, an STL editor) is located in the right half of the window. The left half contains a syntax-controlled variable editor.

**Syntax-controlled variable editor**

1. In the syntax-controlled variable editor, click the "Local" (Lokal) button.
2. Select the following: menu "Device" (Geräte) -> submenu "PS40" -> menu item "PS416".

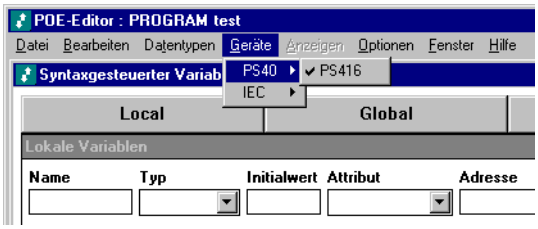



Figure 5-106 Selecting the PS416

Before entering the SUCOM variable, you need to accept the custom function block SUCOM_A.

3. Select "Custom function block" (Hersteller-Funktionsbaustein) from the "Data types" (Datentypen) menu.
4. Select "SUCOM_A" from the following list.
5. Confirm the selection by clicking the "Accept" (Übernehmen) button.
6. Enter the following variables one by one.

Table 5-560 Variable declaration for SUCOM_A

| Name | Type | Initial Value | Attribute | Address | Comment |
|---|---|---|---|---|---|
| Start | BOOL | – | – | – | Start Bit |
| Slot | UINT | – | – | – | Slot |
| ErrorReceive | UINT | – | – | – | Receive Error |
| ErrorTransmit | UINT | – | – | – | Transmit error |
| ErrorSlot | UINT | – | – | – | Slot Error |
| StatusInterface | UINT | – | – | – | Bus group OK |
| ActiveTransmit | UINT | – | – | – | Sending active |
| ActiveReceive | UINT | – | – | – | Receiving active |
| SUCOM | SUCOM_A | – | – | – | FB call |

The table only contains the variables required for communication.

7. To save the variables, select "Save as" (Speichern unter) from the "File" (Datei) menu.

**STL editor**

In the STL editor is where you write the function block call and transfer the parameters 'Enable' and 'Slotnumber'.

You can enter the following lines with the keyboard or have the lines for the function block inserted automatically.

1. For this purpose, go the line containing the function block call and select the menu item "Custom function block" (Hersteller-Funktionsbausteine) from the "Symbols" menu.

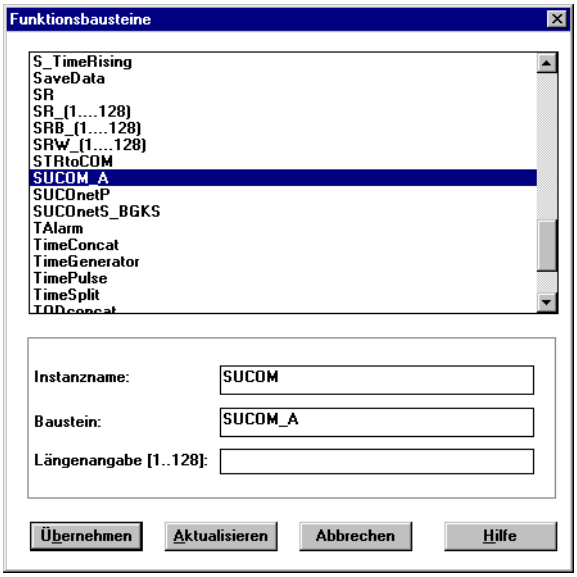



Figure 5-107 Selecting a function block

2. Enter an instance name for the function block (SUCOM).
3. Confirm the entry by clicking the "Accept" (Übernehmen) button.

The function block call should look like this:

```
ld 1st startld 0st slotCAL SUCOM( Enable := start, SlotNumber := Slot | Error-
Receive := ReceiveError, ErrorTransmit := TransmitError, ErrorSlot := SlotEr-
ror, StatusInterface := InterfaceStatus, ActiveTransmit := TransmitActive,
ActiveReceive := ReceiveActive )
```

4. From the "File" (Datei) menu, select "Syntax check" (Syntaxprüfung).

**Creating program code**

After writing the program you need to generate the program code.

1. Start generating the code by double-clicking the corresponding icon.
2. From the "Generation" (Generierung) menu in the "Program code creation" (Programmcode-Erzeugung) window, select "Create generation list automatically" (Generierliste automatisch erstellen).

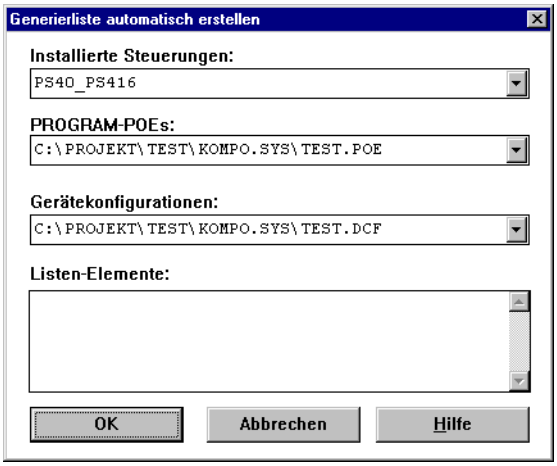



Figure 5-108 Dialog "Create generation list automatically" (Generierliste automatisch erstellen)

3. Confirm the information in the text fields by clicking the OK button.

The generation list is now created.

4. To start program creation, select the menu item "Generate entire project" (Ganzes Projekt generieren) from the menu "Generate" (Generieren).

The compilation must run with no error messages.

**Loading the firmware**

1. Connect the PS416 with the serial interface of the PC by means of the download cable.
2. Double-click the corresponding icon to start the "Test and commissioning" (Test und Inbetriebnahme) function.
3. Click the "Connect" (Ankoppeln) button to establish the connection.
4. Click the "Transfer" button.
5. In the dialog window that appears, select the OSF file for the operating system.
6. Click the "Run" (Ausführen) button to start transferring the operating system.

After a successful transfer process, you are returned to the "Transfer" window.

**Loading the PLC program**

1. Select the PCD file created as a result of the program code generation.
2. Click the "Run" (Ausführen) button to start transferring the program.
3. Click the "Close" (Schließen) button to close the "Transfer" window.

You are returned to the "Communication configuration" (Kommunikationskonfiguration) window.

4. Click the "Program status" button.
5. Select the name of the project from the window that appears.
6. Connect the operating device with the controller.
7. Boot the operating device.
8. Click the "Set operation mode" (Anlauf setzen) and then the "Cold start" button.

The controller will reboot and be placed in the RUN state.

The connection to the operating device through the SBI interface is established within just a few seconds.

## 5.35 SUCOM1 PS4-201

The SUCOM1 PS4-201 protocol provides you

– random read and write access to all flags of the controller
– bit access to all flag types

The size of the address area depends on the controller being used.

Before individual bits can be accessed for a write operation, a read access to the addressed word is performed. Then the write access to the bit can be carried out. For this type of access, you must therefore ensure that the operating device and the controller do not modify individual bits of the same word.

### 5.35.1 Data Types

Direct access is possible to the following data types.

Table 5-561 SUCOM1 PS4-201 data types

| Type | Mnemonic | Access |
|---|---|---|
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Word Access |
| Process Status Word | PS | Word Access |
| Diagnostics Word | DS | Word Access |
| Diagnostics Counter | DZ | Word Access (Read Only) |

## 5.35.2 Programming

### 5.35.2.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.35.2.1.1 Baud Rate

This parameter specifies the communication rate.

Table 5-562 Baud rate

| Configurable Values (Baud) | Default value |
|---|---|
| 300 | |
| 600 | |
| 1200 | |
| 2400 | |
| 4800 | |
| 9600 | X |
| 19200 | |
| 38400 | |
| 57600 | |
| 76800 | |
| 115200 | |

#### 5.35.2.1.2 Parity

This parameter specifies the parity used to control the communication.

Table 5-563 Parity

| Configurable Values | Default Value |
|---|---|
| None | X |
| Even | |
| Odd | |

#### 5.35.2.1.3 Handshake

This parameter specifies the method used to control the communication.

Table 5-564 Handshake

| Configurable values | Default Value |
|---|---|
| No Handshake | X |
| Hardware | |
| Software | |

#### 5.35.2.1.4 Data Bits

This parameter specifies the number of data bits.

Table 5-565 Data bits

| Configurable Values | Default Value |
|---|---|
| 5 | |
| 6 | |
| 7 | |
| 8 | X |

#### 5.35.2.1.5 Stop Bits

This parameter specifies the number of stop bits.

Table 5-566 Stop bits

| Configurable Values | Default Value |
|---|---|
| 1 | |
| 1.5 | |
| 2 | X |

#### 5.35.2.1.6 Swap LED Output

This parameter specifies whether the bytes responsible for controlling the LEDs in the polling area are to be swapped (byte swapping).

Table 5-567 Swap LED output

| Configurable Values | Default Value |
|---|---|
| ON | |
| OFF | X |

#### 5.35.2.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

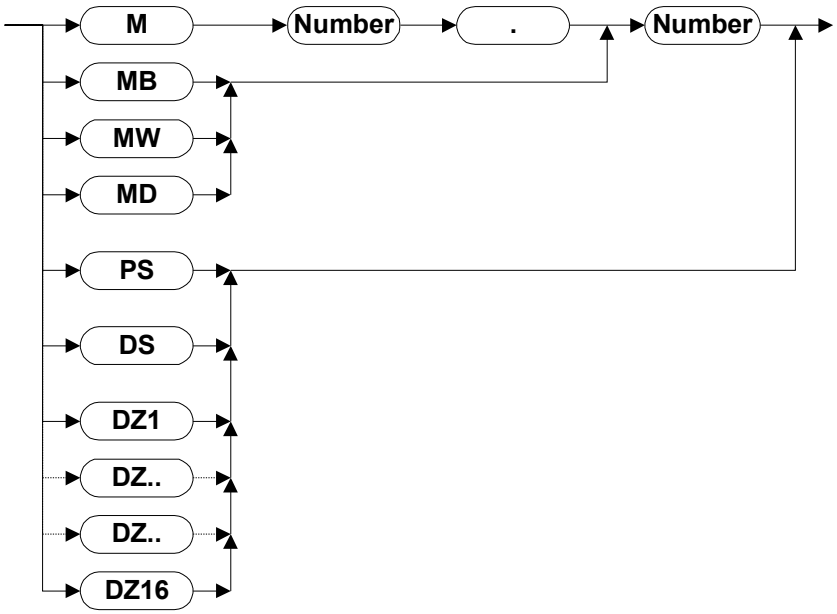



Figure 5-109 Syntax diagram

### 5.35.3 Physical Interfacing

Plug-in connectors on the operating device for connection to the controller.

#### 5.35.3.1 Pin Assignment for Operating Devices with an Universal Interface

Table 5-568 Pin assignment SER1 RS232

| Pin | Designation | Function |
|---|---|---|
| 6 | TD | Transmitted Data |
| 15 | CTS | Clear to Send |
| 17 | RTS | Request to Send |
| 18 | RD | Received Data |
| 25 | SGND | Signal Ground |

The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.35.3.2 Pin Assignment for Operating Devices without an Universal Interface

Table 5-569 Pin assignment RS232

| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not Connected |
| 2 | RD | Received Data |
| 3 | TD | Transmitted Data |
| 4 | DTR | Data Terminal Ready |
| 5 | GND | Ground |
| 6 | nc | Not Connected |
| 7 | RTS | Request to Send |
| 8 | CTS | Clear to Send |
| 9 | nc | Not Connected |

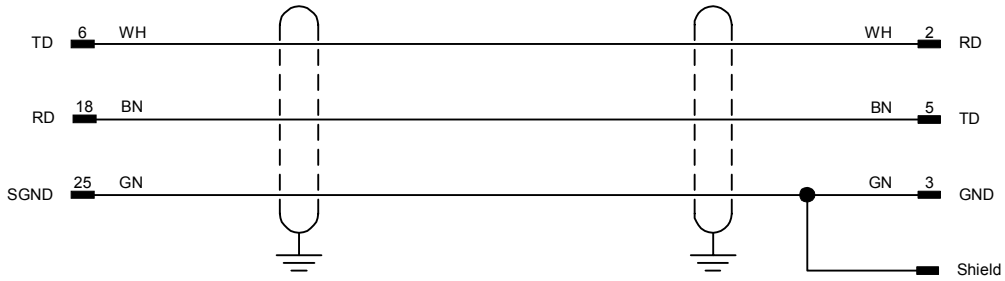
The D-SUB connector strips must be shielded sufficiently.
See chapter “Shielding D-SUB Connectors“ on page 6-1.

#### 5.35.3.3 Cable X3 SER1 RS232 - Moeller PS4-201

The following cabling diagram applies to operating devices with an universal interface **only**.

Operating device

Moeller
PS4-201




D-SUB
male connector
25 pin

DIN 41524
angled
male connector
8 pin

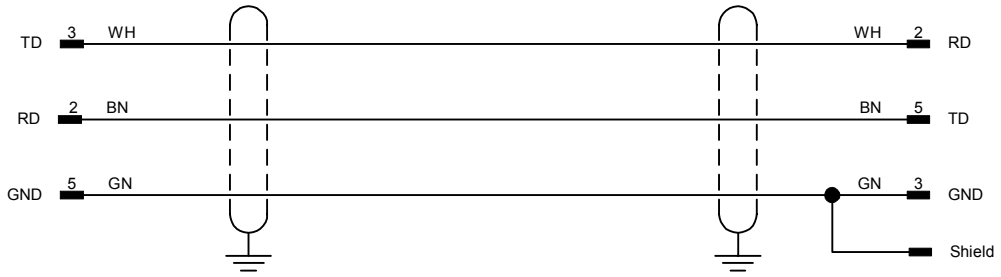
Both ends of the shield are connected to the metallic housing.

#### 5.35.3.4 Cable X2 RS232 - Moeller PS4201

The following cabling diagram does **not** apply to operating devices with an universal interface.

Operating device

Moeller
PS4-201




D-SUB
male connector
9 pin

DIN 41524
angled
male connector
8 pin

Both ends of the shield are connected to the metallic housing.

### 5.35.4 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-570 SUCOM1 PS4-201 error messages

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 1 | | Slave not ready | Wrong slave address or connecting cable not plugged-in properly |
| 2 | | Packets out of sequence | |
| 3 | | Protocol framing error | |
| 4 | | Waiting time elapsed (Timeout) | Connection broken. |
| 5 | | CRC error | |
| 6 | | Wrong parity | |
| 7 | | Send process aborted | |
| 8 | | Receive process aborted | |
| 9 | | Cyclic buffer overrun | Cyclic buffer too small |
| 10 | | No cyclic data defined | |
| 12 | | Cyclic data already defined | |
| 15 | | Protocol error | The selected protocol is not supported. |
| 16 | | Receive buffer overrun | |
| 17 | | NAK from controller | |
| 40 | | System variable error | Undefined system variable |
| SUCOM1-specific error messages | | | |
| 50 | | Wrong acknowledgment during connection setup | |
| 51 | | No acknowledgment after data transmission | |
| 52 | | No response telegram | |
| 53 | | Incorrect number of data received | Check if the mask, in which the error occurred, contains a variable with an odd number of bytes which accesses a word address or a double-word address. |
| 54 | | No STX upon receipt of data block | |

## 5.36 SUCOnet K

The technical data for the SUCOnet K bus system are as follows:

– bus interface in accordance with RS485,
– linear bus structure,
– up to 124 participants on one bus,
– bus access according to the master/slave principle,
– transmission rate 187.5/375 kBaud,
– cable length of up to 600 m (1967.999 feet) - (without repeater),
– asynchronous and half-duplex data transfer,
– UART character format in accordance with IEC FT1.2,
– definable telegram length,
– data security through longitudinal parity and vertical parity and
– CRC16 check procedure can additionally be activated.

The TesiMod operating device is a slave and its station address must be in the range of 2 to 31.

It is theoretically possible to access the inputs and outputs of all stations connected to the bus. The inputs and outputs are, however, not located at fixed addresses but are - based on the configuration - dynamically loaded into the memory of the controller when the controller is started.Efficient accesses to these data is therefore not possible.

The flag area, by contrast, is a linear memory area in the controller and can therefore be accessed very efficiently and with little decoding effort. Because of the above-stated reasons, TesiMod operating devices are only capable of accessing the flag area of the master.

If you also want to access other SUCOnet K devices, you need to modify the corresponding program block of the master. You must copy the inputs and outputs of these devices to the flag area of the master.

You must call a separate program block for each operating device. The program blocks SUCBT1 to SUCBT8 are currently available for the PS4-201 controller. These program blocks allow you to integrate up to 8 operating devices into the bus of the SUCOnet K. For other controller types, you might have to modify the program blocks.

When required, the program blocks evaluate the data received from the operating device. Additional program blocks are called during this process, depending on whether you are reading or writing a bit or a byte.

You need to define the telegram length when the controller is programmed. This can be accomplished by means of the SUCOsoft programming software.

These data are updated after every program cycle, when required. This gives the controller control over which data the operating devices reads and writes.

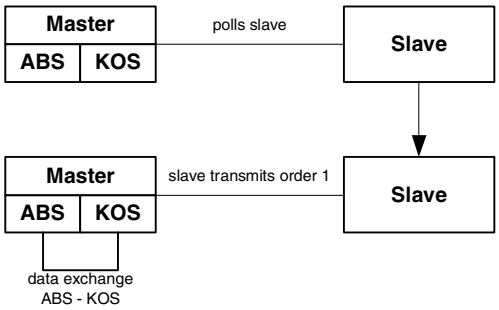



Figure 5-110 1st poll/program cycle - SUCOnet K

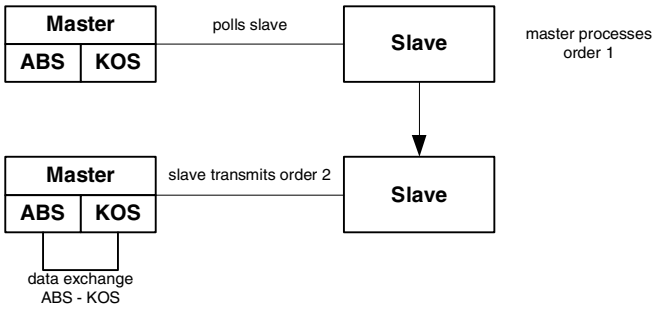



Figure 5-111 2nd poll/program cycle - SUCOnet K

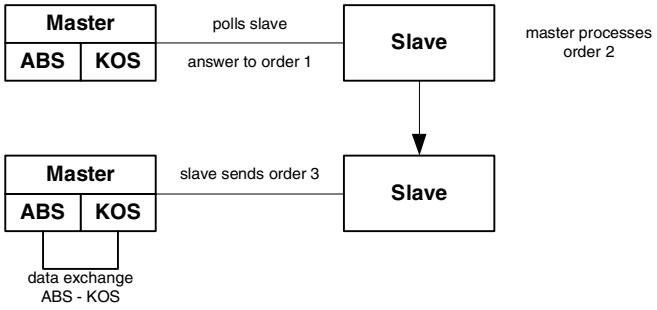



Figure 5-112 3rd poll/program cycle - SUCOnet K

ABS = Image memory

KOS = Communication memory

## 5.36.1 Telegrams for the communication

### 5.36.1.1 Telegram for Bit Access

The telegram consists of 5 control bytes and n bytes of user data. If you are writing your own controller program for the communication, you need to take into account the functions the control bytes fulfill and make them available.

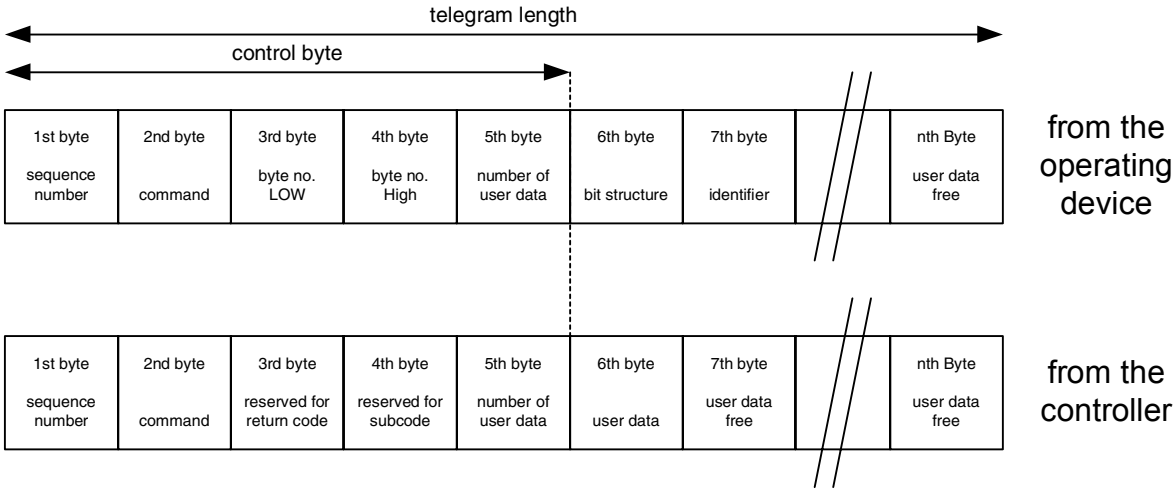



Figure 5-113 Telegram from the operating device for bit access

**Sequence number** This byte contains the sequence number of the commands from the operating device to the controller. The controller program must copy this sequence number into the response telegram.

**Command** This byte defines the access method. Permitted access methods are bit or byte access in read or write mode. The command byte must be copied over by means of the controller program. The following commands are currently supported.

Table 5-571 Supported commands

| Command | Description |
|---|---|
| 0x00 | Bit read access |
| 0x01 | Byte read access |
| 0x02 | Bit write access |
| 0x03 | Byte write access |

**Byte number LOW and HIGH** These two bytes contain the byte number of the flag byte to which the operation applies. The controller program accesses these memory locations to find out the destination address. In the response telegram, these memory locations are reserved for the return code and the subcode and are therefore not available for the user.

**Number of User Data** Contains the number of user data of the telegram. The controller must copy this memory location into the response telegram.

**Bit structure and identifier** The bit structure and the identifier contain useful data only in the case of a bit-write request. If the identifier is "0", you must link the bit structure with the memory location by applying the AND-operation. If the identifier is "1", you must link the bit structure with the memory location by applying the OR-operation.

**User data**

In the case of a bit-read request, the flag byte which contains the corresponding bit is copied into the response telegram of the controller after the byte "Number of User Data" ("Anzahl Nutzdaten"). The remaining user data are not used during a bit access.

### 5.36.1.2 Telegram for Byte Access

The telegram consists of 5 control bytes and n bytes of user data. If you are writing your own controller program for the communication, you need to take into account the functions the control bytes fulfill and make them available.

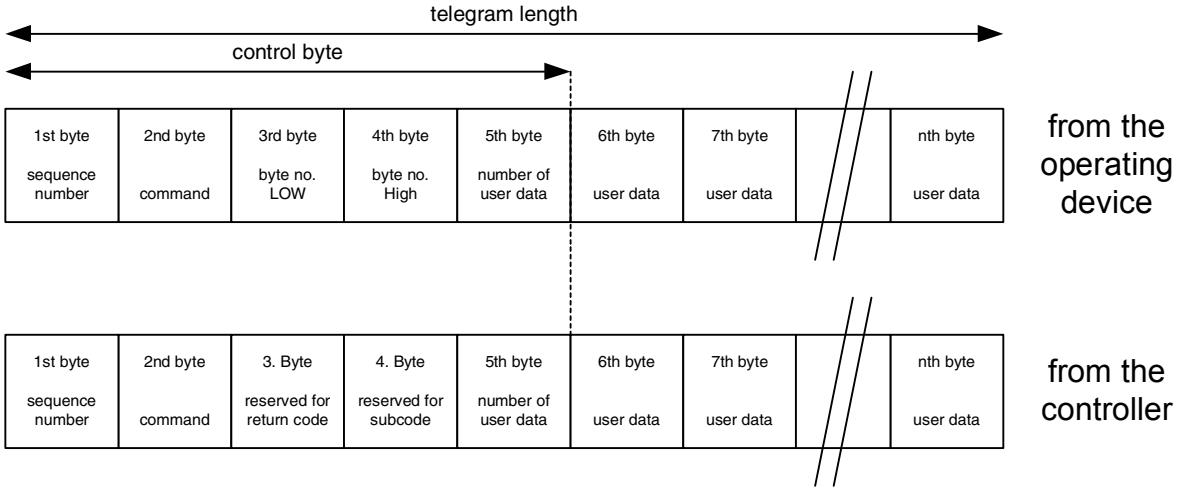



Figure 5-114 Telegram from operating device for byte access

**Sequence number**

This byte contains the sequence number of the commands from the operating device to the controller. The controller program must copy this sequence number into the response telegram.

**Command**

This byte defines the access method. Permitted access methods are bit or byte access in read or write mode. The command byte must be copied over by means of the controller program. The following commands are currently supported.

Table 5-572 Supported commands

| Command | Description |
|---|---|
| 0x00 | Bit read access |
| 0x01 | Byte read access |
| 0x02 | Bit write access |
| 0x03 | Byte write access |

**Byte number LOW and HIGH**

These two bytes contain the byte number of the flag byte to which the operation applies. The controller program accesses these memory locations to find out the destination address. In the response telegram, these memory locations are reserved for the return code and the subcode and are therefore not available for the user.

**Number of user data**

Contains the number of user data of the telegram. The controller must copy this memory location into the response telegram.

**User data**

From here onwards is where you find the user data of the transmission. In the case of a write request, the data located here are the values that are transferred from the operating device to the controller.The controller must copy these values into the flag area. In the case of a read request, the controller program must copy the values from the flag area to this location in the response telegram.

### 5.36.2 Data Types

Direct access is possible to the following data types.

Table 5-573 SUCOnet K data types

| Type | Mnemonic | Access |
|---|---|---|
| Flag Bit | M | Bit Access |
| Flag Byte | MB | Byte Access |
| Flag Word | MW | Byte Access |
| Flag Double-Word | MD | Byte Access |

## 5.36.3 Programming

### 5.36.3.1 Protocol Parameters

With the protocol parameters, you can adapt the communication of the controller used.

#### 5.36.3.1.1 Maximum Waiting Time For Response

This parameter specifies how long the operating device waits for a response from the controller.

Table 5-574 Maximum waiting time for response

| Configurable Values | Default Value |
|---|---|
| 10 ms to 2550 ms | 100 ms |

#### 5.36.3.1.2 Delay until Connection Set-Up

This parameter specifies the waiting time after which the operating device starts the communication.

Table 5-575 Delay until connection set-up

| Configurable Values | Default Value |
|---|---|
| 1 s to 25 s | 10 s |

#### 5.36.3.1.3 Slave Number

This parameter specifies the slave number of the operating device within the SUCOnet K structure.

Table 5-576 Slave number

| Configurable Values | Default Value |
|---|---|
| 2 to 31 | 2 |

#### 5.36.3.1.4 Length of Data Telegram

This parameter specifies the telegram length used for the communication.

Table 5-577 Length of data telegram

| Configurable Values | Default Value |
|---|---|
| 10 to 96 | 20 |

A small value should be defined for the telegram length if the emphasis is to keep the load on the bus low. A larger value should be used if an efficient data exchange is of primary importance.

Because of the 5 control bytes, the user data length is shorter than indicated above. .

See chapter “Telegrams for the communication“ on page 5-521.

#### 5.36.3.2 Input Syntax

The following figure illustrates the structure of the input syntax for variables in the programming software.

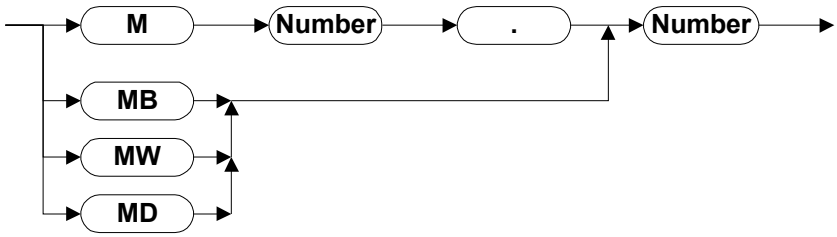



Figure 5-115 Syntax diagram

## 5.36.4 Physical Interfacing

### 5.36.4.1 Pin Assignment

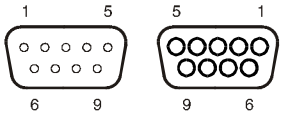



Figure 5-116 9 pin D-SUB male connector strip and female connector strip

Connector in the operating device: 9 pin D-SUB male and female connector strip

The operating devices to be connected to the SUCOnet K bus are equipped with a standardized interface. In case of devices with only one female connector, a special T-piece must be used. Spur lines from the outgoing bus cable to one of the stations should NOT exceed a length of 0.3 m (11.811").

Switch on the bus terminating resistors on the physically first station (master) and last station. The terminating resistors of the stations located in between must remain switched OFF.To activate the bus termination, switch the termination switch RD/TD to ON.

Table 5-578 Pin assignment X2.1 / X2.2 SUCOnet K

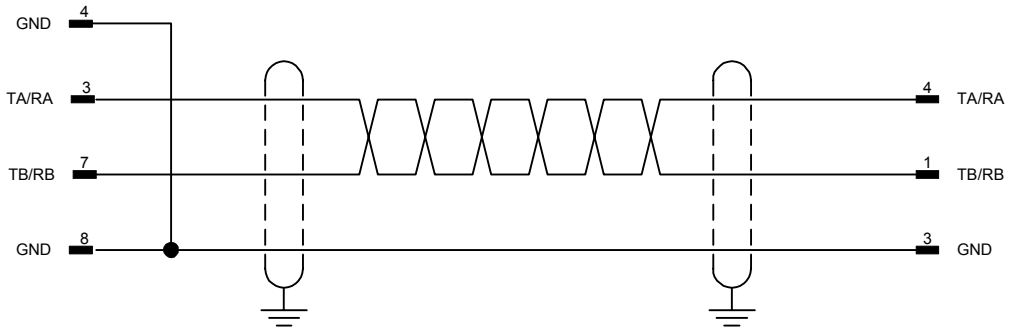
| Pin | Designation | Function |
|---|---|---|
| 1 | nc | Not connected |
| 2 | nc | Not connected |
| 3 | TA/RA | Send/receive channel A |
| 4 | GND | Ground |
| 5 | nc | Not connected |
| 6 | nc | Not connected |
| 7 | nc | Not connected |
| 8 | TB/RB | Send/receive channel B |
| 9 | nc | Not connected |

### 5.36.4.2 Cable X2.1 X2.2 SUCOnet K

This cable only applies to operating devices with 9 pin DSUB connectors for the interfaces X2.1 and X2.2.

Operating device

Master or Slave
SUCOnet K




D-SUB
male connector
9 pin

DIN
male connector
5 pin

### 5.36.5 Error Messages

Error messages are displayed on the operating device along with a code and subcode. Error messages are composed as follows.

Communication Error

Code XXXXX

Subcode XXXXX

Retries XXXXX

Table 5-579 Error messages for SUCOnet K

| Code | Subcode | Error Type | Possible Cause |
|---|---|---|---|
| 50 | | Initialization error | The connection between the TesiMod operating device and the SUCOnet interface is faulty. |
| 51 | | Waiting time elapsed | The operating device sent a request, but no response was received within the waiting time. |
| | XXXX | The subcode specifies the number of the flag byte which you wanted to access. | |
| 60 | 2 | Master in STOP state | |
| | 4 | Receiving length incorrect | Perhaps you did not specify the same telegram length for the two communication partners. |
| | 64 | Master disconnected | A connection could not yet be established or the connection has been disconnected. |

# 6 Shielding D-SUB Connectors

You must shield D-SUB connectors as follows:

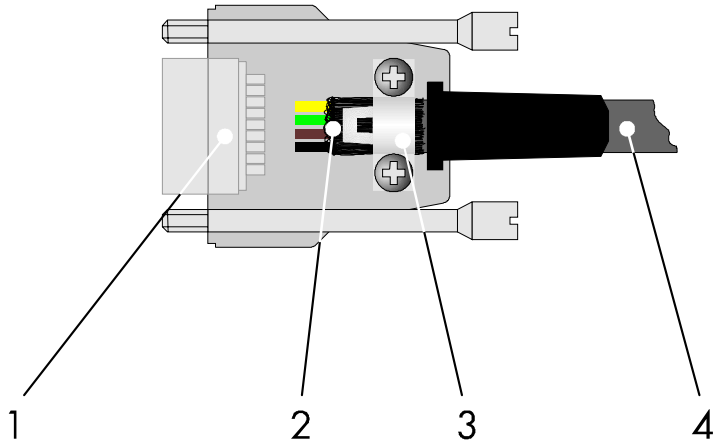



Figure 6-1 Shielding D-SUB connectors

**1** D-SUB connector

**2** Shield

**3** Cable clip

**4** Cable

The shield must be folded back into a flat position over the cable sheath.

When fastening the cable with the cable clip, as much of the shielding as possible must be in contact with the housing and sufficient strain relieve must be ensured.

# A Table of Figures


Figure 3-1 : Structure of the counter word in Siemens S5-115U ..... 3-15
Figure 3-2 : Horizontal bars..... 3-23
Figure 3-3 : Vertical bars..... 3-24
Figure 3-4 : Example of fill status display..... 3-25
Figure 3-5 : Example for displaying a curve..... 3-26
Figure 3-6 : Scaling of the input variables in the operating device..... 3-31
Figure 3-7 : Rounding of the input variables in the operating device..... 3-31
Figure 3-8 : Scaling of the output variables in the operating device ..... 3-32
Figure 3-9 : Scaling of the output variables..... 3-32
Figure 3-10 : Inserting the variable values in the formula ..... 3-32
Figure 3-11 : Solving the equation ..... 3-33
Figure 3-12 : Solving the equation for x ..... 3-33
Figure 3-13 : Flow diagram for PLC handshake ..... 3-34
Figure 3-14 : Selective access..... 3-35
Figure 3-15 : Text with the Underline attribute..... 3-94
Figure 3-16 : Text with the Inverse attribute..... 3-94
Figure 3-17 : Text with the Flashing attribute..... 3-95
Figure 3-18 : Structure of a set of curves..... 3-96
Figure 3-19 : Button ..... 3-99
Figure 3-20 : Button with horizontal layout..... 3-100
Figure 3-21 : Button with vertical layout..... 3-101
Figure 3-22 : Image for a basic frame..... 3-101
Figure 3-23 : Image split into four areas ..... 3-102
Figure 3-24 : Determining and expanding frame edges..... 3-102
Figure 3-25 : Button: Final result..... 3-103
Figure 3-26 : Structure of the messages system ..... 3-143
Figure 3-27 : Data transfer to the controller (operator-controlled)..... 3-170
Figure 3-28 : Data transfer to the operating device (operator-controlled)..... 3-171
Figure 3-29 : Error message FLASH MEMORY FAILURE ..... 3-183
Figure 5-1 : Syntax diagram..... 5-14
Figure 5-2 : Example of a variable declaration for global variables ..... 5-47
Figure 5-3 : Window 'Global variables'..... 5-47
Figure 5-4 : Dialog 'Options' - symbol configuration..... 5-48
Figure 5-5 : Dialog 'Set object attributes' ..... 5-48
Figure 5-6 : Dialog 'Options' - directories..... 5-49
Figure 5-7 : Dialog 'Target settings' ..... 5-49
Figure 5-8 : Example of a variable declaration for global variables ..... 5-61
Figure 5-9 : Window 'Global variables'..... 5-61
Figure 5-10 : Dialog 'Options' - symbol configuration..... 5-62
Figure 5-11 : Dialog 'Set object attributes' ..... 5-62
Figure 5-12 : Dialog 'Options' - directories..... 5-63
Figure 5-13 : Variable list..... 5-63
Figure 5-14 : Dialog 'Mask element Variable'..... 5-64
Figure 5-15 : Example of a variable declaration for global variables ..... 5-75
Figure 5-16 : Window 'Global variables'..... 5-75
Figure 5-17 : Dialog 'Options' - symbol configuration..... 5-76
Figure 5-18 : Dialog 'Set object attributes' ..... 5-76
Figure 5-19 : Dialog 'Options' - directories..... 5-77
Figure 5-20 : Variable list..... 5-77
Figure 5-21 : Dialog 'Mask element Variable'..... 5-78
Figure 5-22 : Arcnet telegram setup..... 5-79
Figure 5-23 : Modbus telegram in the Arcnet data frame..... 5-79
Figure 5-24 : Syntax diagram..... 5-84
Figure 5-25 : Syntax diagram for ABB CS31 ..... 5-94
Figure 5-26 : Syntax diagram..... 5-104
Figure 5-27 : Syntax diagram..... 5-118

Figure 5-28 : Syntax diagram ..... 5-128
Figure 5-29 : Syntax diagram ..... 5-142
Figure 5-30 : Syntax diagram for Bosch BUEP19E ..... 5-154
Figure 5-31 : Communication relations for CAN ..... 5-172
Figure 5-32 : Syntax diagram ..... 5-176
Figure 5-33 : Communication relations for CAN ..... 5-180
Figure 5-34 : Data exchange, DeviceNet ..... 5-183
Figure 5-35 : Syntax diagram for DeviceNet ..... 5-190
Figure 5-36 : DeviceNet for Rockwell SLC 505-1747 SDN/B ..... 5-203
Figure 5-37 : DeviceNet for OMRON DRM 21-V1 ..... 5-203
Figure 5-38 : DIN Measurement Bus structure ..... 5-205
Figure 5-39 : Structure of poll area for DIN Measurement Bus ..... 5-207
Figure 5-40 : Structure of the 4-byte area for the network status ..... 5-209
Figure 5-41 : Cable X3 SER1 RS485 - master/slave ..... 5-218
Figure 5-42 : Cable X2 RS485 - master/slave ..... 5-219
Figure 5-43 : Syntax diagram ..... 5-224
Figure 5-44 : Syntax diagram ..... 5-234
Figure 5-45 : Connection of operating device, bus node and INTERBUS ..... 5-241
Figure 5-46 : Syntax diagram ..... 5-247
Figure 5-47 : Syntax diagram ..... 5-258
Figure 5-48 : Structure of the OB1 when using a bus node ..... 5-266
Figure 5-49 : Structure of the OB1 for multiple operating devices with bus node ..... 5-267
Figure 5-50 : Structure of OB100 and OB101 ..... 5-267
Figure 5-51 : Syntax diagram ..... 5-287
Figure 5-52 : Syntax diagram ..... 5-296
Figure 5-53 : Syntax diagram ..... 5-307
Figure 5-54 : Syntax diagram ..... 5-319
Figure 5-55 : 9 pin D-SUB male connector strip and female connector strip 5-320
Figure 5-56 : Overview of function blocks from Sütron electronic ..... 5-335
Figure 5-57 : Syntax diagram ..... 5-355
Figure 5-58 : Syntax diagram OMRON NT-Link C series ..... 5-368
Figure 5-59 : Syntax diagram OMRON NT-Link CV series ..... 5-369
Figure 5-60 : Syntax diagram OMRON NT-Link CS1 series ..... 5-370
Figure 5-61 : Syntax diagram for bit access, PROFIBUS-DP. ..... 5-401
Figure 5-62 : Syntax diagram for byte access, PROFIBUS-DP. ..... 5-401
Figure 5-63 : Syntax diagram for word access, PROFIBUS-DP. ..... 5-401
Figure 5-64 : Syntax diagram for double-word access, PROFIBUS-DP ..... 5-401
Figure 5-65 : 9 pin D-SUB female connector strip ..... 5-402
Figure 5-66 : Connecting cable PROFIBUS-DP ..... 5-402
Figure 5-67 : Dialog 'Install New GSD' ..... 5-406
Figure 5-68 : Hardware catalog ..... 5-407
Figure 5-69 : Dialog 'Properties - PROFIBUS interface TesiMod BT ..... 5-407
Figure 5-70 : Hardware configuration ..... 5-408
Figure 5-71 : Dialog 'Properties - DP Slave' ..... 5-409
Figure 5-72 : Dialog 'Insert External Source' ..... 5-409
Figure 5-73 : How the function blocks work ..... 5-411
Figure 5-74 : Bit access for PROFIBUS using a Siemens S7 ..... 5-413
Figure 5-75 : Byte access for PROFIBUS using a Siemens S7 ..... 5-413
Figure 5-76 : Word access for PROFIBUS using a Siemens S7 ..... 5-413
Figure 5-77 : Double-word access for PROFIBUS using a Siemens S7 ..... 5-413
Figure 5-78 : Structure of FB110 ..... 5-415
Figure 5-79 : Protocol parameters for PROFIBUS using a Siemens S5 ..... 5-417
Figure 5-80 : Bit access for PROFIBUS using a Siemens S5 ..... 5-417
Figure 5-81 : Byte access for PROFIBUS using a Siemens S5 ..... 5-417
Figure 5-82 : Word access for PROFIBUS using a Siemens S5 ..... 5-417
Figure 5-83 : Double-word access for PROFIBUS using a Siemens S5 ..... 5-417
Figure 5-84 : Structure of the BT_MAIN ..... 5-422
Figure 5-85 : Bit access for PROFIBUS using the Bosch CL series ..... 5-425

Figure 5-86 : Byte access for PROFIBUS using the Bosch CL series ..... 5-425
Figure 5-87 : Word access for PROFIBUS with the Bosch CL series ..... 5-425
Figure 5-88 : Double-word access for PROFIBUS using the Bosch CL series ..... 5-425
Figure 5-89 : Syntax diagram ..... 5-433
Figure 5-90 : Syntax diagram ..... 5-443
Figure 5-91 : Syntax diagram ..... 5-452
Figure 5-92 : Syntax diagram ..... 5-467
Figure 5-93 : Termination of cable ends for Siemens S7 PPI ..... 5-472
Figure 5-94 : Syntax diagram ..... 5-479
Figure 5-95 : Syntax diagram for SUCOM1 PS306/316 ..... 5-494
Figure 5-96 : Setting for address 1 ..... 5-501
Figure 5-97 : Setting for the terminating resistors ..... 5-501
Figure 5-98 : Setting for transparent mode ..... 5-501
Figure 5-99 : RS232 setting for PRG interface ..... 5-501
Figure 5-100 : Sucosoft S40 Manager ..... 5-502
Figure 5-101 : Selecting the CPU module ..... 5-503
Figure 5-102 : Parameter settings ..... 5-503
Figure 5-103 : Interface parameter settings ..... 5-504
Figure 5-104 : Communication configurator ..... 5-505
Figure 5-105 : Creating a new POE program ..... 5-505
Figure 5-106 : Selecting the PS416 ..... 5-506
Figure 5-107 : Selecting a function block ..... 5-507
Figure 5-108 : Dialog "Create generation list automatically" (Generierliste automatisch erstellen) ..... 5-508
Figure 5-109 : Syntax diagram ..... 5-514
Figure 5-110 : 1st poll/program cycle - SUCOnet K ..... 5-520
Figure 5-111 : 2nd poll/program cycle - SUCOnet K ..... 5-520
Figure 5-112 : 3rd poll/program cycle - SUCOnet K ..... 5-520
Figure 5-113 : Telegram from the operating device for bit access ..... 5-521
Figure 5-114 : Telegram from operating device for byte access ..... 5-522
Figure 5-115 : Syntax diagram ..... 5-525
Figure 5-116 : 9 pin D-SUB male connector strip and female connector strip 5-526
Figure 6-1 : Shielding D-SUB connectors ..... 6-1

# B Table of Tables


Table 3-1 : User mode switch with four switches set to Standard Mode ..... 3-1
Table 3-2 : User mode switch with eight switches set to Standard Mode..... 3-1
Table 3-3 : User mode switch with four switches set to Demo Mode ..... 3-2
Table 3-4 : User mode switch with eight switches set to Demo Mode..... 3-2
Table 3-5 : Variable types..... 3-10
Table 3-6 : Key functions for decimal numbers of the type Standard ..... 3-12
Table 3-7 : Example for timer values ..... 3-14
Table 3-8 : Key functions for decimal numbers of the type Timer..... 3-14
Table 3-9 : Key functions for decimal numbers of the type Counter..... 3-15
Table 3-10 : Key functions for decimal numbers of the type BCD ..... 3-17
Table 3-11 : Key functions for alphanumeric variables..... 3-18
Table 3-12 : Key functions for selection texts ..... 3-19
Table 3-13 : Key functions for selection images ..... 3-20
Table 3-14 : Key functions for floating point numbers..... 3-20
Table 3-15 : Key functions for hexadecimal numbers..... 3-21
Table 3-16 : Key functions for binary numbers ..... 3-22
Table 3-17 : Scaling decimal numbers..... 3-31
Table 3-18 : Scaling floating point numbers..... 3-32
Table 3-19 : Text list for example softkey. ..... 3-105
Table 3-20 : Variables for example softkey..... 3-105
Table 3-21 : Control byte of the running time meter ..... 3-107
Table 3-22 : Reset byte of the running time meter..... 3-107
Table 3-23 : Structure of the Read coordination byte ..... 3-108
Table 3-24 : Structure of the Write coordination byte ..... 3-111
Table 3-25 : Byte-oriented polling area..... 3-114
Table 3-26 : Word-oriented polling area ..... 3-116
Table 3-27 : Truth table for a status LED..... 3-117
Table 3-28 : Control Codes..... 3-118
Table 3-29 : Return values from operating device..... 3-122
Table 3-30 : Return values from operating device..... 3-122
Table 3-31 : Image of date and time with a 4-digit year..... 3-129
Table 3-32 : Image of date and time with a 2-digit year..... 3-129
Table 3-33 : Text list for operating devices with a Z80-CPU or RISC-CPU . 3-129
Table 3-34 : Text list for operating devices with a 386 CPU ..... 3-130
Table 3-35 : Default values for SER2 ..... 3-139
Table 3-36 : Truth table for a parallel output..... 3-141
Table 3-37 : Parameters for print logs ..... 3-142
Table 3-38 : System Messages ..... 3-144
Table 3-39 : System variables for messages..... 3-157
Table 3-40 : Memory space / memory requirement..... 3-162
Table 3-41 : Memory use for 500 messages ..... 3-162
Table 3-42 : Structure of variables for status messages with 2 bytes..... 3-163
Table 3-43 : Recipe for the product 'clamp' ..... 3-164
Table 3-44 : Recipe for the product 'shaft' ..... 3-164
Table 3-45 : System variables for recipes..... 3-165
Table 3-46 : Start of file identifier..... 3-174
Table 3-47 : End of file identifier ..... 3-174
Table 3-48 : Data set header ..... 3-174

Table 3-49 : Data set variables ..... 3-174
Table 3-50 : End of data set identifier ..... 3-174
Table 3-51 : Memories in operating devices in comparison ..... 3-176
Table 3-52 : Memory use for 500 messages in comparison ..... 3-176
Table 3-53 : Structure of the control word for the parallel outputs ..... 3-179
Table 3-54 : Truth table for a parallel output ..... 3-179
Table 4-1 : User mode switch with four switches - Transparent Mode ..... 4-1
Table 4-2 : User mode switch with four switches - Transparent Mode ..... 4-2
Table 4-3 : Interface parameters ..... 4-3
Table 4-4 : Display sizes of the operating devices ..... 4-4
Table 4-5 : Key codes for each operating device ..... 4-5
Table 4-6 : Non-displayable control characters ..... 4-7
Table 4-7 : Codes for the status LEDs in the keys ..... 4-8
Table 4-8 : Nomenclature for the control sequences ..... 4-9
Table 4-9 : Control sequences ..... 4-9
Table 5-1 : Connection set-up telegram for the 3964 procedure ..... 5-3
Table 5-2 : Data Request telegram for the 3964 procedure ..... 5-3
Table 5-3 : Data Request Telegram header for the 3964 procedure ..... 5-4
Table 5-4 : Specification of the data types in the "Data Request" telegram header ..... 5-5
Table 5-5 : Response telegram for the 3964 procedure ..... 5-6
Table 5-6 : Data transmission telegram for the 3964 procedure ..... 5-6
Table 5-7 : Data transmission telegram header for the 3964 procedure ..... 5-6
Table 5-8 : Specifying the destination information for a write-access via a data block ..... 5-7
Table 5-9 : 3964 RK512 data types ..... 5-8
Table 5-10 : Baud rate ..... 5-10
Table 5-11 : Parity ..... 5-10
Table 5-12 : Handshake ..... 5-10
Table 5-13 : Data bits ..... 5-11
Table 5-14 : Stop bits ..... 5-11
Table 5-15 : Use coordination flag ..... 5-11
Table 5-16 : Coordination flag ..... 5-11
Table 5-17 : Bit number ..... 5-11
Table 5-18 : Data block number ..... 5-12
Table 5-19 : Data block word ..... 5-12
Table 5-20 : Floating point number in the Siemens format ..... 5-12
Table 5-21 : Block check ..... 5-12
Table 5-22 : CPU number ..... 5-12
Table 5-23 : Full duplex ..... 5-13
Table 5-24 : Half duplex ..... 5-13
Table 5-25 : Pin assignment TTY / 20 mA, active ..... 5-15
Table 5-26 : Pin assignment SER1 RS232 ..... 5-15
Table 5-27 : Pin assignment RS485 ..... 5-15
Table 5-28 : Pin assignment TTY / 20 mA, active ..... 5-16
Table 5-29 : Pin assignment RS232 ..... 5-16
Table 5-30 : Pin assignment X2 RS485 ..... 5-16
Table 5-31 : Error messages - 3964/RK512 ..... 5-32
Table 5-32 : Directories for the function blocks ..... 5-34
Table 5-33 : Supported destination specifications for Siemens S5 115U ..... 5-34
Table 5-34 : Protocol parameters for TTY / 20 mA ..... 5-36

Table 5-35 : Protocol parameters for TTY / 20 mA ..... 5-36
Table 5-36 : Data types for the poll area ..... 5-44
Table 5-37 : Byte lengths for the date and time ..... 5-44
Table 5-38 : 3S sarti error messages ..... 5-46
Table 5-39 : Baud rate ..... 5-52
Table 5-40 : Parity ..... 5-52
Table 5-41 : Data bits ..... 5-52
Table 5-42 : Stop bits ..... 5-52
Table 5-43 : Waiting time for response ..... 5-53
Table 5-44 : Delay until Connection Set-Up ..... 5-53
Table 5-45 : Byte order ..... 5-53
Table 5-46 : Controllers ..... 5-53
Table 5-47 : Dats types for the poll area ..... 5-53
Table 5-48 : Length of the Message System in Bytes ..... 5-54
Table 5-49 : Byte lengths for the date and time ..... 5-54
Table 5-50 : Pin assignment SER1 RS232 ..... 5-55
Table 5-51 : Pin assignment RS232 ..... 5-55
Table 5-52 : Error messages for 3S serial ..... 5-60
Table 5-53 : Baud rate ..... 5-66
Table 5-54 : Parity ..... 5-66
Table 5-55 : Data bits ..... 5-66
Table 5-56 : Stop bits ..... 5-66
Table 5-57 : Waiting Time for Response ..... 5-67
Table 5-58 : Delay until Connection Set-Up ..... 5-67
Table 5-59 : Byte order ..... 5-67
Table 5-60 : Controllers ..... 5-67
Table 5-61 : Data types for the poll area ..... 5-68
Table 5-62 : Byte lengths for the date and time ..... 5-68
Table 5-63 : Pin assignment SER1 RS232 ..... 5-69
Table 5-64 : Pin assignment X2 RS232 ..... 5-69
Table 5-65 : Error messages for 3S symbolic ..... 5-74
Table 5-66 : Modbus query by master (operating device) ..... 5-80
Table 5-67 : Modbus response by slave (controller) ..... 5-80
Table 5-68 : Data Types ..... 5-80
Table 5-69 : Maximum waiting time for response ..... 5-82
Table 5-70 : Delay until connection set-up ..... 5-82
Table 5-71 : Node address ..... 5-82
Table 5-72 : Maximum number of nodes ..... 5-83
Table 5-73 : Number of nodes and timeout value ..... 5-83
Table 5-74 : Initializing values for timer ..... 5-83
Table 5-75 : Variable syntax for inputs ..... 5-84
Table 5-76 : Variable syntax for outputs ..... 5-85
Table 5-77 : Variable syntax for flag area ..... 5-85
Table 5-78 : Variable syntax for constants ..... 5-85
Table 5-79 : Variable syntax for step sequence ..... 5-86
Table 5-80 : Word-oriented polling area ..... 5-86
Table 5-81 : Parallel message system ..... 5-86
Table 5-82 : Internally used flag addresses ..... 5-87
Table 5-83 : Pin assignment for RJ45 female connector ..... 5-88
Table 5-84 : Error messages for ABB Arcnet ..... 5-90

Table 5-85 : Data types - ABB CS31 ..... 5-91
Table 5-86 : Baud rate ..... 5-92
Table 5-87 : Parity ..... 5-92
Table 5-88 : Handshake ..... 5-92
Table 5-89 : Data bits ..... 5-93
Table 5-90 : Stop bits ..... 5-93
Table 5-91 : Maximum waiting time for response ..... 5-93
Table 5-92 : Delay until connection setup ..... 5-93
Table 5-93 : Word-oriented poll area - ABB CS31 ..... 5-94
Table 5-94 : Parallel message system - ABB CS31 ..... 5-95
Table 5-95 : Pin assignment SER1 RS232 ..... 5-96
Table 5-96 : Pin assignment RS232 ..... 5-96
Table 5-97 : ABB CS31 error messages ..... 5-98
Table 5-98 : Data types - ABB T200 ..... 5-99
Table 5-99 : Value ranges for the data types ..... 5-100
Table 5-100 : Baud rate ..... 5-101
Table 5-101 : Parity ..... 5-101
Table 5-102 : Handshake ..... 5-101
Table 5-103 : Data bits ..... 5-102
Table 5-104 : Stop bits ..... 5-102
Table 5-105 : Maximum waiting time for response ..... 5-102
Table 5-106 : Delay until connection set-up ..... 5-102
Table 5-107 : Assignment of slave number to office number and L.U.M.P. ..... 5-103
Table 5-108 : 1:N communication ..... 5-103
Table 5-109 : Access authorization control ..... 5-103
Table 5-110 : Word-oriented poll area - ABB T200 ..... 5-104
Table 5-111 : Parallel message system - ABB T200 ..... 5-105
Table 5-112 : Pin assignment SER1 RS232 ..... 5-106
Table 5-113 : Pin assignment RS485 ..... 5-106
Table 5-114 : Pin assignment RS232 ..... 5-106
Table 5-115 : Pin assignment X2 RS485 ..... 5-107
Table 5-116 : ABB T200 error messages ..... 5-112
Table 5-117 : Data types - AEG KS functions ..... 5-115
Table 5-118 : Baud rate ..... 5-116
Table 5-119 : Parity ..... 5-116
Table 5-120 : Handshake ..... 5-116
Table 5-121 : Data bits ..... 5-117
Table 5-122 : Stop bits ..... 5-117
Table 5-123 : Pin assignment TTY / 20 mA, active ..... 5-119
Table 5-124 : Pin assignment SER1 RS232 ..... 5-119
Table 5-125 : Pin assignment RS485 ..... 5-119
Table 5-126 : Pin assignment TTY / 20 mA, active ..... 5-120
Table 5-127 : Pin assignment RS232 ..... 5-120
Table 5-128 : Pin assignment X2 RS485 ..... 5-120
Table 5-129 : AEG KS error messages ..... 5-124
Table 5-130 : Allen Bradley data types ..... 5-125
Table 5-131 : Baud rate ..... 5-126
Table 5-132 : Parity ..... 5-126
Table 5-133 : Handshake ..... 5-126
Table 5-134 : Data bits ..... 5-127

Table 5-135 : Stop bits ..... 5-127
Table 5-136 : PLC Type ..... 5-127
Table 5-137 : Block check ..... 5-127
Table 5-138 : Pin assignment SER1 RS232 ..... 5-129
Table 5-139 : Pin assignment RS485 ..... 5-129
Table 5-140 : Pin assignment RS232 ..... 5-129
Table 5-141 : Pin assignment X2 RS485 ..... 5-130
Table 5-142 : Allen Bradley error messages ..... 5-135
Table 5-143 : Data types for Bosch BUEP19 ..... 5-137
Table 5-144 : Baud rate ..... 5-139
Table 5-145 : Parity ..... 5-139
Table 5-146 : Handshake ..... 5-139
Table 5-147 : Data bits ..... 5-140
Table 5-148 : Stop bits ..... 5-140
Table 5-149 : Use coordination flag ..... 5-140
Table 5-150 : Coordination flag ..... 5-140
Table 5-151 : Bit number ..... 5-140
Table 5-152 : Destination module ..... 5-141
Table 5-153 : Block Check ..... 5-141
Table 5-154 : Pin assignment TTY / 20 mA, active ..... 5-143
Table 5-155 : Pin assignment TTY / 20 mA, active ..... 5-143
Table 5-156 : Error Messages for Bosch BUEP19 ..... 5-146
Table 5-157 : Data types for Bosch BUEP19E ..... 5-149
Table 5-158 : Baud rate, Bosch PU BUEP19E ..... 5-151
Table 5-159 : Parity, Bosch PU BUEP19E ..... 5-151
Table 5-160 : Handshake, Bosch PU BUEP19E ..... 5-151
Table 5-161 : Data bits, Bosch PU BUEP19E ..... 5-152
Table 5-162 : Stop bits, Bosch PU BUEP19E ..... 5-152
Table 5-163 : Use coordination flag, Bosch PU BUEP19E ..... 5-152
Table 5-164 : Coordination flag, Bosch PU BUEP19E ..... 5-152
Table 5-165 : Process coordination flag, Bosch PU BUEP19E ..... 5-153
Table 5-166 : Destination module, Bosch PU BUEP19E ..... 5-153
Table 5-167 : Block check, Bosch PU BUEP19E ..... 5-153
Table 5-168 : Pin assignment TTY / 20 mA, active ..... 5-155
Table 5-169 : Pin assignment TTY / 20 mA, active ..... 5-155
Table 5-170 : Error Messages for Bosch BUEP19E ..... 5-158
Table 5-171 : Structure of request and response PDO ..... 5-162
Table 5-172 : Structure of the status byte in a request and response PDO ..... 5-162
Table 5-173 : User data, bit-oriented in a byte address ..... 5-163
Table 5-174 : User data, bit-oriented in a word address ..... 5-163
Table 5-175 : User data, byte-oriented in a word address ..... 5-164
Table 5-176 : User data, double-word oriented in a word address ..... 5-164
Table 5-177 : Structure of the response object containing an error ..... 5-164
Table 5-178 : Object dictionary for CANopen ..... 5-166
Table 5-179 : Guard time for CANopen ..... 5-167
Table 5-180 : Life time factor for CANopen ..... 5-167
Table 5-181 : Store parameters for CANopen ..... 5-168
Table 5-182 : Store parameters for CANopen ..... 5-168
Table 5-183 : Baud rate ..... 5-169
Table 5-184 : Maximum waiting time for response ..... 5-169

Table 5-185 : Delay until connection set-up ..... 5-169
Table 5-186 : Register errors in serial message system ..... 5-169
Table 5-187 : Error messages for the serial message system for CAN ..... 5-170
Table 5-188 : Use CANopen ..... 5-170
Table 5-189 : Terminal status on the bus ..... 5-170
Table 5-190 : NMT commands ..... 5-171
Table 5-191 : Node guarding for SDO channels ..... 5-171
Table 5-192 : Terminal module numberr ..... 5-172
Table 5-193 : Communication over ..... 5-172
Table 5-194 : Mode ..... 5-173
Table 5-195 : Connected with ..... 5-173
Table 5-196 : Module number ..... 5-173
Table 5-197 : Identifier ..... 5-173
Table 5-198 : Default address type in bytes ..... 5-173
Table 5-199 : Word-oriented polling area - CAN ..... 5-174
Table 5-200 : Pin assignment X2.1 / X2.2 CAN bus ..... 5-177
Table 5-201 : CAN error messages ..... 5-178
Table 5-202 : Variable list for CAN ..... 5-181
Table 5-203 : Explanation of the addresses ..... 5-181
Table 5-204 : Memory object addresses ..... 5-183
Table 5-205 : Structure of the Explicit Message for the Read service ..... 5-184
Table 5-206 : Structure of the Explicit Message for the Write service ..... 5-185
Table 5-207 : Structure of the Consumed Data ..... 5-186
Table 5-208 : Structure of the Produced Data ..... 5-186
Table 5-209 : Baud rate ..... 5-188
Table 5-210 : Node number ..... 5-188
Table 5-211 : Delay until connection set-up ..... 5-188
Table 5-212 : Waiting time for response ..... 5-188
Table 5-213 : Explicit Message contains the Attribute parameter ..... 5-189
Table 5-214 : Byte order ..... 5-189
Table 5-215 : Addresses in the data memory of the operating device ..... 5-190
Table 5-216 : Statuses of the module/network LED ..... 5-190
Table 5-217 : Initialization states of the data memory ..... 5-191
Table 5-218 : Object definitions ..... 5-191
Table 5-219 : Instance Attribute of the Identity Object ..... 5-191
Table 5-220 : Instance Service of the Identity Object ..... 5-192
Table 5-221 : Class Service of the DeviceNet Object ..... 5-192
Table 5-222 : Instance Attribute of the DeviceNet Object ..... 5-192
Table 5-223 : Instance Service of the Identity Object ..... 5-192
Table 5-224 : Class Service of the Connection Object ..... 5-192
Table 5-225 : Instance Attribute of the Connection Object ..... 5-193
Table 5-226 : Instance Service of the Connection Object ..... 5-193
Table 5-227 : Instance Service of the BT Object ..... 5-193
Table 5-228 : Request without Attribute parameter ..... 5-193
Table 5-229 : Response without Attribute parameter ..... 5-194
Table 5-230 : Request with Attribute parameter ..... 5-194
Table 5-231 : Response with Attribute parameter ..... 5-194
Table 5-232 : Request without Attribute parameter ..... 5-195
Table 5-233 : Response without Attribute parameter ..... 5-195
Table 5-234 : Request with Attribute parameter ..... 5-195

Table 5-235 : Response with Attribute parameter ..... 5-195
Table 5-236 : Format of the Explicit Message ..... 5-197
Table 5-237 : Pin assignment X2.1 / X2.2 CAN bus ..... 5-200
Table 5-238 : DeviceNet error messages ..... 5-202
Table 5-239 : Function of the individual bytes ..... 5-207
Table 5-240 : Baud rate, DIN Measurement Bus master ..... 5-209
Table 5-241 : Parity, DIN Measurement Bus master ..... 5-210
Table 5-242 : Handshake, DIN Measurement Bus master ..... 5-210
Table 5-243 : Data bits, DIN Measurement Bus master ..... 5-210
Table 5-244 : Stop bits, DIN Measurement Bus master ..... 5-210
Table 5-245 : Slave number, DIN Measurement Bus master ..... 5-211
Table 5-246 : Additional error messages, DIN Measurement Bus ..... 5-212
Table 5-247 : Baud rate, DIN Measurement Bus slave ..... 5-214
Table 5-248 : Parity, DIN Measurement Bus slave ..... 5-214
Table 5-249 : Handshake, DIN Measurement Bus slave ..... 5-214
Table 5-250 : Data bits, DIN Measurement Bus slave ..... 5-215
Table 5-251 : Stop bits, DIN Measurement Bus slave ..... 5-215
Table 5-252 : Timeout for order reply, DIN Measurement Bus slave ..... 5-215
Table 5-253 : Timeout for cache update, DIN Measurement Bus slave ..... 5-215
Table 5-254 : Slave number, DIN Measurement Bus slave ..... 5-216
Table 5-255 : Pin assignment RS485 ..... 5-217
Table 5-256 : Pin assignment X2 RS485 ..... 5-217
Table 5-257 : Error messages, DIN Measurement Bus ..... 5-220
Table 5-258 : Fanuc SNP data types ..... 5-221
Table 5-259 : Baud rate ..... 5-222
Table 5-260 : Parity ..... 5-222
Table 5-261 : Handshake ..... 5-222
Table 5-262 : Data bits ..... 5-223
Table 5-263 : Stop bits ..... 5-223
Table 5-264 : Maximum waiting time for response ..... 5-223
Table 5-265 : Delay until connection set-up ..... 5-223
Table 5-266 : Pin assignment RS485 ..... 5-225
Table 5-267 : Pin assignment X2 RS485 ..... 5-225
Table 5-268 : Fanuc SNP error messages ..... 5-230
Table 5-269 : Idec Micro3 data types ..... 5-231
Table 5-270 : Baud rate ..... 5-232
Table 5-271 : Parity ..... 5-232
Table 5-272 : Handshake ..... 5-232
Table 5-273 : Data bits ..... 5-233
Table 5-274 : Stop bits ..... 5-233
Table 5-275 : Maximum waiting time for response ..... 5-233
Table 5-276 : Delay until connection set-up ..... 5-233
Table 5-277 : Pin assignment RS485 ..... 5-235
Table 5-278 : Pin assignment X2 RS485 ..... 5-235
Table 5-279 : Idec Micro3 error messages ..... 5-238
Table 5-280 : MMI structure for BK06 with 8 inputs and 8 outputs: ..... 5-242
Table 5-281 : MMI structure for BK06 with 16 inputs and 8 outputs ..... 5-242
Table 5-282 : Data types for INTERBUS BK06 ..... 5-243
Table 5-283 : Baud rate ..... 5-244
Table 5-284 : Parity ..... 5-244

Table 5-285 : Handshake ..... 5-245
Table 5-286 : Data bits ..... 5-245
Table 5-287 : Stop bits ..... 5-245
Table 5-288 : MMICOM handshake timeout ..... 5-245
Table 5-289 : Maximum waiting time for response ..... 5-245
Table 5-290 : Delay until connection set-up ..... 5-246
Table 5-291 : Floating point number in the Siemens format ..... 5-246
Table 5-292 : Pin assignment SER1 RS232 ..... 5-248
Table 5-293 : Pin assignment RS232 ..... 5-248
Table 5-294 : Pin assignment RS232 ..... 5-248
Table 5-295 : Error messages for INTERBUS MMICOM Interface 02, 10, 15, 23 ..... 5-251
Table 5-296 : PCP structure with 8 inputs and 8 outputs ..... 5-253
Table 5-297 : Data types for INTERBUS Siemens S7 Functions ..... 5-254
Table 5-298 : Baud rate ..... 5-255
Table 5-299 : Parity ..... 5-255
Table 5-300 : Handshake ..... 5-255
Table 5-301 : Data bits ..... 5-256
Table 5-302 : Stop bits ..... 5-256
Table 5-303 : MMICOM handshake timeout ..... 5-256
Table 5-304 : Delay until connection set-up ..... 5-256
Table 5-305 : Floating point number in the Siemens format ..... 5-257
Table 5-306 : Pin assignment SER1 RS232 ..... 5-259
Table 5-307 : Pin assignment RS232 ..... 5-259
Table 5-308 : Pin assignment RS232 ..... 5-259
Table 5-309 : Error messages for INTERBUS Siemens S7 Functions ..... 5-262
Table 5-310 : FB71 parameters ..... 5-268
Table 5-311 : FB71 variable declaration ..... 5-268
Table 5-312 : Variable declaration for FB171 ..... 5-273
Table 5-313 : Parameters for the function FC11 ..... 5-274
Table 5-314 : Parameters for the function FC12 ..... 5-275
Table 5-315 : Parameters for the function FC13 ..... 5-276
Table 5-316 : Parameters for the function FC14 ..... 5-277
Table 5-317 : Parameters for the function FC18 ..... 5-278
Table 5-318 : Parameters for the function FC19 ..... 5-279
Table 5-319 : Parameters for the function FC78 ..... 5-279
Table 5-320 : Jetter data types ..... 5-281
Table 5-321 : Valid addresses for Jetter (input/output/flag) ..... 5-282
Table 5-322 : Register addresses for PASE-E ..... 5-282
Table 5-323 : Register addresses for PCOM5/7 ..... 5-282
Table 5-324 : Register Addresses for JetControl ..... 5-282
Table 5-325 : Baud rate ..... 5-284
Table 5-326 : Parity ..... 5-284
Table 5-327 : Handshake ..... 5-284
Table 5-328 : Data bits ..... 5-285
Table 5-329 : Stop bits ..... 5-285
Table 5-330 : Maximum waiting time for response ..... 5-285
Table 5-331 : Delay until connection set-Up ..... 5-285
Table 5-332 : Jetter CPU type ..... 5-285
Table 5-333 : Jetter protocol type ..... 5-286
Table 5-334 : Structure of poll area/status messages ..... 5-286

Table 5-335 : Poll area 16 out of 24 bits ..... 5-287
Table 5-336 : Poll Area 16 Out of 32 Bits (Full Length) ..... 5-287
Table 5-337 : Status messages 16 out of 2 ..... 5-288
Table 5-338 : Status messages 24 out of 24 ..... 5-288
Table 5-339 : Status Messages 32 out of 32 (Full Length) ..... 5-288
Table 5-340 : Pin assignment SER1 RS232 ..... 5-289
Table 5-341 : Pin assignment RS232 ..... 5-289
Table 5-342 : Jetter error messages ..... 5-292
Table 5-343 : Mitsubishi FX data types ..... 5-293
Table 5-344 : Baud rate ..... 5-294
Table 5-345 : Parity ..... 5-294
Table 5-346 : Handshake ..... 5-294
Table 5-347 : Data bits ..... 5-295
Table 5-348 : Stop bits ..... 5-295
Table 5-349 : Maximum waiting time for response ..... 5-295
Table 5-350 : Delay until connection set-up ..... 5-295
Table 5-351 : Pin assignment RS485 ..... 5-297
Table 5-352 : Pin assignment X2 RS485 ..... 5-297
Table 5-353 : Mitsubishi FX/FX0 error messages ..... 5-302
Table 5-354 : Mitsubishi MelsecA data types ..... 5-303
Table 5-355 : Baud rate ..... 5-305
Table 5-356 : Parity ..... 5-305
Table 5-357 : Handshake ..... 5-305
Table 5-358 : Data bits ..... 5-306
Table 5-359 : Stop bits ..... 5-306
Table 5-360 : Maximum waiting time for response ..... 5-306
Table 5-361 : Delay until connection set-up ..... 5-306
Table 5-362 : Mitsubishi CPU type ..... 5-306
Table 5-363 : Pin assignment RS485 ..... 5-308
Table 5-364 : Pin assignment X2 RS485 ..... 5-308
Table 5-365 : Mitsubishi MelsecA error messages ..... 5-311
Table 5-366 : Parameters for the operating devices on the INTERBUS ..... 5-315
Table 5-367 : MMICOM handshake timeout ..... 5-316
Table 5-368 : Delay until connection set-up ..... 5-316
Table 5-369 : Floating point number in the Siemens format ..... 5-316
Table 5-370 : Additional function - polling area, MMICOM ..... 5-317
Table 5-371 : Status messages, MMICOM ..... 5-317
Table 5-372 : Data types, MMICOM ..... 5-317
Table 5-373 : Pin assignment remote bus in (INTERBUS) ..... 5-320
Table 5-374 : Pin assignment remote bus out (INTERBUS) ..... 5-320
Table 5-375 : Error Messages - MMICOM ..... 5-323
Table 5-376 : Parameters for IBS data sets ..... 5-326
Table 5-377 : Parameters for the FC20 function ..... 5-327
Table 5-378 : Parameters for the FC21 function ..... 5-331
Table 5-379 : Parameters for the FC22 function ..... 5-332
Table 5-380 : Parameters for the FC28 function ..... 5-333
Table 5-381 : Parameters for the FC60 function ..... 5-337
Table 5-382 : Parameters for the FC66 function ..... 5-338
Table 5-383 : Parameters for the FC80 function ..... 5-339
Table 5-384 : Parameters for the FC86 function ..... 5-340

Table 5-385 : Parameters for the FC65 function ..... 5-341
Table 5-386 : Parameters for the FC85 function ..... 5-342
Table 5-387 : Client/server/slave connections ..... 5-345
Table 5-388 : Controller ..... 5-346
Table 5-389 : Maximum waiting time for response ..... 5-346
Table 5-390 : Delay until connection set-up ..... 5-346
Table 5-391 : Word swap in double-word ..... 5-346
Table 5-392 : Use host name table from file ..... 5-347
Table 5-393 : Host name table ..... 5-347
Table 5-394 : Variable list, Modbus TCP ..... 5-348
Table 5-395 : Poll area for Modbus TCP ..... 5-348
Table 5-396 : Error messages for Modbus TCP ..... 5-349
Table 5-397 : OMRON Host-Link data types ..... 5-351
Table 5-398 : Baud rate ..... 5-353
Table 5-399 : Parity ..... 5-353
Table 5-400 : Handshake ..... 5-353
Table 5-401 : Data bits ..... 5-354
Table 5-402 : Stop bits ..... 5-354
Table 5-403 : Maximum waiting time for response ..... 5-354
Table 5-404 : Delay until Connection Set-Up ..... 5-354
Table 5-405 : Mode ..... 5-354
Table 5-406 : Word-oriented poll area - OMRON NT-Link ..... 5-355
Table 5-407 : Parallel message system ..... 5-356
Table 5-408 : Pin assignment SER1 RS232 ..... 5-357
Table 5-409 : Pin assignment RS232 ..... 5-357
Table 5-410 : OMRON Host-Link error messages ..... 5-360
Table 5-411 : Data types for the C series ..... 5-361
Table 5-412 : Data types for the CV-series: ..... 5-362
Table 5-413 : Data types for the CS1-series ..... 5-362
Table 5-414 : Baud rate ..... 5-364
Table 5-415 : Parity ..... 5-364
Table 5-416 : Handshake ..... 5-364
Table 5-417 : Data bits ..... 5-365
Table 5-418 : Stop bits ..... 5-365
Table 5-419 : Maximum waiting time for response ..... 5-365
Table 5-420 : Delay until Connection Set-Up ..... 5-365
Table 5-421 : NT module number ..... 5-366
Table 5-422 : Protocol Mode ..... 5-366
Table 5-423 : Priority ..... 5-366
Table 5-424 : Duplex Operation ..... 5-366
Table 5-425 : PLC type ..... 5-367
Table 5-426 : Word-oriented poll area - OMRON NT-Link ..... 5-370
Table 5-427 : Parallel message system ..... 5-371
Table 5-428 : Pin assignment SER1 RS232 ..... 5-372
Table 5-429 : Pin assignment RS485 ..... 5-372
Table 5-430 : Pin assignment RS232 ..... 5-372
Table 5-431 : Pin assignment X2 RS485 ..... 5-373
Table 5-432 : OMRON NT-Link error messages ..... 5-380
Table 5-433 : Maximum waiting time for response ..... 5-382
Table 5-434 : Delay until connection set-up ..... 5-382

Table 5-435 : Poll area, with three single variables ..... 5-382
Table 5-436 : Objects for ARRAY OF BYTE..... 5-383
Table 5-437 : Control command byte..... 5-383
Table 5-438 : Image of date and time with a 2-digit year..... 5-384
Table 5-439 : Image of date and time with a 4-digit year..... 5-384
Table 5-440 : Phoenix SSGI error messages ..... 5-386
Table 5-441 : Baud rate ..... 5-388
Table 5-442 : Maximum waiting time for response ..... 5-388
Table 5-443 : Delay until Connection Set-Up..... 5-388
Table 5-444 : Poll area..... 5-389
Table 5-445 : Pin assignment SER1 RS232..... 5-390
Table 5-446 : Pin assignment RS232 ..... 5-390
Table 5-447 : ProComm plus error messages ..... 5-393
Table 5-448 : Request telegram ..... 5-396
Table 5-449 : Number of User Data..... 5-396
Table 5-450 : Access ..... 5-397
Table 5-451 : Response telegram..... 5-397
Table 5-452 : Writing to a byte address ..... 5-398
Table 5-453 : Writing to a word address ..... 5-398
Table 5-454 : Maximum waiting time for response ..... 5-399
Table 5-455 : Delay until connection set-up..... 5-399
Table 5-456 : Station number ..... 5-399
Table 5-457 : Telegram length..... 5-399
Table 5-458 : Floating point format ..... 5-399
Table 5-459 : Byte order ..... 5-400
Table 5-460 : Adress width ..... 5-400
Table 5-461 : Pin assignment PROFIBUS-DP..... 5-402
Table 5-462 : Cable specification for PROFIBUS ..... 5-403
Table 5-463 : Cable recommendations for PROFIBUS ..... 5-403
Table 5-464 : Connector recommendations for PROFIBUS ..... 5-403
Table 5-465 : Transfer speed versus line length for PROFIBUS ..... 5-403
Table 5-466 : Error Messages for PROFIBUS-DP..... 5-404
Table 5-467 : SFC14 parameters ..... 5-411
Table 5-468 : FC80 parameters..... 5-412
Table 5-469 : SFC15 parameters ..... 5-412
Table 5-470 : The DP identifier via module 0..... 5-413
Table 5-471 : FB111 - Byte code in byte 2 ..... 5-416
Table 5-472 : FB111 - Byte code in byte 2 ..... 5-416
Table 5-473 : Function blocks for the programming software WINSPS..... 5-418
Table 5-474 : Parameters for function block BT_PB345..... 5-420
Table 5-475 : Function blocks for the programming software PROFI..... 5-421
Table 5-476 : Byte code in byte 2 ..... 5-423
Table 5-477 : Byte code in byte 2 ..... 5-423
Table 5-478 : Protocol parameters for the Bosch CL series ..... 5-424
Table 5-479 : Protocol parameters for the Bosch CL series ..... 5-424
Table 5-480 : Hexadecimal notation for addresses ..... 5-425
Table 5-481 : Supported Simatic S5 types ..... 5-427
Table 5-482 : Simatic S5 types not supported ..... 5-427
Table 5-483 : Data types for Siemens S5 PG (AS511)..... 5-428
Table 5-484 : Baud rate ..... 5-430

Table 5-485 : Parity ..... 5-430
Table 5-486 : Handshake ..... 5-430
Table 5-487 : Data bits ..... 5-431
Table 5-488 : Stop bits ..... 5-431
Table 5-489 : Maximum waiting time for response ..... 5-431
Table 5-490 : Delay until connection set-up ..... 5-432
Table 5-491 : Fast data block access ..... 5-432
Table 5-492 : Pin assignment TTY / 20 mA, active ..... 5-434
Table 5-493 : Pin assignment TTY / 20 mA, active ..... 5-434
Table 5-494 : Error messages for Siemens S5 PG ..... 5-437
Table 5-495 : Siemens S7 MPI data types for operating devices with a Z80 and 386 CPU ..... 5-439
Table 5-496 : Siemens S7 MPI data types for operating devices with a RISC CPU ..... 5-440
Table 5-497 : Baud rate ..... 5-441
Table 5-498 : Delay until Connection Set-Up ..... 5-441
Table 5-499 : Participant address of terminal ..... 5-441
Table 5-500 : Highest participant address ..... 5-442
Table 5-501 : Offline operation ..... 5-442
Table 5-502 : Connection list for Siemens S7 MPI ..... 5-442
Table 5-503 : Byte-oriented poll area for Siemens S7 MPI ..... 5-443
Table 5-505 : Parallel message system for Siemens S7 MPI ..... 5-444
Table 5-504 : Word-oriented poll area for Siemens S7 MPI ..... 5-444
Table 5-506 : Pin assignment X2 MPI ..... 5-445
Table 5-507 : Parameters for MPI cables ..... 5-446
Table 5-508 : Error messages for Siemens S7 MPI ..... 5-447
Table 5-509 : Siemens S7 MPI data types ..... 5-449
Table 5-510 : Baud rate ..... 5-450
Table 5-511 : Delay until connection set-up ..... 5-450
Table 5-512 : Participant address of terminal ..... 5-451
Table 5-513 : Highest participant address ..... 5-451
Table 5-514 : Connection list ..... 5-451
Table 5-515 : Byte-oriented poll area for Siemens S7 MPI ..... 5-452
Table 5-517 : Parallel message system for Siemens S7 MPI ..... 5-453
Table 5-516 : Word-oriented poll area for Siemens S7 MPI ..... 5-453
Table 5-518 : Pin assignment SER1 RS232 ..... 5-454
Table 5-519 : Pin assignment RS232 ..... 5-454
Table 5-520 : Error messages for Siemens S7 MPI (HMI adapter) ..... 5-458
Table 5-521 : Siemens S7 PPI data types ..... 5-463
Table 5-522 : Baud rate ..... 5-464
Table 5-523 : Parity ..... 5-464
Table 5-524 : Handshake ..... 5-464
Table 5-525 : Data bits ..... 5-465
Table 5-526 : Stop bits ..... 5-465
Table 5-527 : Maximum waiting time for response ..... 5-465
Table 5-528 : Delay until connection set-up ..... 5-465
Table 5-529 : Station number of the terminal ..... 5-466
Table 5-530 : Word-oriented poll area for Siemens S7 PPI ..... 5-468
Table 5-531 : Parallel message system for Siemens S7 PPI ..... 5-468
Table 5-532 : Pin assignment RS485 ..... 5-469
Table 5-533 : Pin assignment X2 RS485 ..... 5-469

Table 5-534 : Error messages for Siemens S7-PPI ..... 5-473
Table 5-535 : Simatic S5 types with a PG interface ..... 5-475
Table 5-536 : Data types - Siemens L1 master ..... 5-475
Table 5-537 : Baud rate ..... 5-477
Table 5-538 : Parity ..... 5-477
Table 5-539 : Handshake ..... 5-477
Table 5-540 : Data bits ..... 5-478
Table 5-541 : Stop bits ..... 5-478
Table 5-542 : Maximum waiting time for response ..... 5-478
Table 5-543 : Delay until connection set-Up ..... 5-478
Table 5-544 : Pin assignment TTY / 20 mA, active ..... 5-480
Table 5-545 : Pin assignment TTY / 20 mA, active ..... 5-480
Table 5-546 : Error messages for Sinec L1 Master ..... 5-483
Table 5-547 : Directories for the function blocks ..... 5-485
Table 5-548 : Parameters in FB200 ..... 5-486
Table 5-549 : Supported controller types ..... 5-491
Table 5-550 : SUCOM1 PS306/316 data types ..... 5-491
Table 5-551 : Baud rate ..... 5-492
Table 5-552 : Parity ..... 5-492
Table 5-553 : Handshake ..... 5-492
Table 5-554 : Data bits ..... 5-493
Table 5-555 : Stop bits ..... 5-493
Table 5-556 : Swap LED output ..... 5-493
Table 5-557 : Pin assignment RS485 ..... 5-495
Table 5-558 : Pin assignment X2 RS485 ..... 5-495
Table 5-559 : Error messages for SUCOM1 PS306/316 ..... 5-500
Table 5-560 : Variable declaration for SUCOM_A ..... 5-506
Table 5-561 : SUCOM1 PS4-201 data types ..... 5-511
Table 5-562 : Baud rate ..... 5-512
Table 5-563 : Parity ..... 5-512
Table 5-564 : Handshake ..... 5-512
Table 5-565 : Data bits ..... 5-513
Table 5-566 : Stop bits ..... 5-513
Table 5-567 : Swap LED output ..... 5-513
Table 5-568 : Pin assignment SER1 RS232 ..... 5-515
Table 5-569 : Pin assignment RS232 ..... 5-515
Table 5-570 : SUCOM1 PS4-201 error messages ..... 5-518
Table 5-571 : Supported commands ..... 5-521
Table 5-572 : Supported commands ..... 5-522
Table 5-573 : SUCOnet K data types ..... 5-523
Table 5-574 : Maximum waiting time for response ..... 5-524
Table 5-575 : Delay until connection set-up ..... 5-524
Table 5-576 : Slave number ..... 5-524
Table 5-577 : Length of data telegram ..... 5-524
Table 5-578 : Pin assignment X2.1 / X2.2 SUCOnet K ..... 5-526
Table 5-579 : Error messages for SUCOnet K ..... 5-528

# C Index

## Numerics

3964 RK512 ..... 5-3
3S sarti ..... 5-43
3S serial ..... 5-51
3S symbolic ..... 5-65

## A

ABB Arcnet ..... 5-79
ABB CS31 ..... 5-91
Access type ..... 3-35
    Normal ..... 3-35
    Selective ..... 3-35
AEG KS ..... 5-115
Allen Bradley ..... 5-125
Application ID ..... 3-177
Attributes ..... 3-37

## B

Bosch BUEP19 ..... 5-137
Bosch BUEP19E ..... 5-149
Buttons ..... 3-99

## C

Cable with BNC connectors
    ABB Arcnet ..... 5-89
Cable with RJ45 connector
    ABB Arcnet ..... 5-89
Cable X2
    CAN ..... 5-177
    PROFIBUS-DP ..... 5-402
Cable X2 - Siemens S7 MPI ..... 5-446
Cable X2 RS232
    ABB CS31 ..... 5-97
    ABB T200 ..... 5-109
    AEG A120 and A250 ..... 5-123
    Allen Bradley SLC 500-5/03 ..... 5-132
    EBERLE PLS514 - K43 ..... 5-31
    Jetter ..... 5-291
    Moeller PS4-201 ..... 5-517
    OMRON Host-Link ..... 5-359
    OMRON NT-Link ..... 5-375
    Schleicher microLine ..... 5-392
    Schraml SPS FWM105 ..... 5-57, 5-71
    Schraml SPS FWM160 ..... 5-59, 5-73
    Siemens S5 CP523/525 ..... 5-21
    Siemens S7 MPI (HMI adapter) ..... 5-456
Cable X2 RS485
    ABB T200 ..... 5-111
    Allen Bradley PLC 5 ..... 5-134
    DIN Measurement Bus master/slave ..... 5-219
    Fanuc Series 90 ..... 5-227, 5-229
    Idec Micro3 ..... 5-237
    Mitsubishi FX ..... 5-299
    Mitsubishi FX0 ..... 5-301
    Mitsubishi MelsecA ..... 5-310
    Moeller PS306 ..... 5-497
    Moeller PS316/PS416 ..... 5-499
    OMRON NT-Link 2-Wire ..... 5-377
    OMRON NT-Link 4-Wire ..... 5-379
    Siemens S5 CP523/525 ..... 5-23
    Siemens S5 with Helmholz CP523/525 ..... 5-25
    Siemens S5 with VIPA BGM79-43 ..... 5-27
    Siemens S7 PPI ..... 5-471
Cable X2 TTY / 20 mA
    Bosch PU ..... 5-145, 5-157
    EBERLE PLS514 - K43 ..... 5-29
    Siemens S5 CP524/525 and Helmholz SAS 523/525 ..... 5-19
    Siemens S5 PG ..... 5-482
Cable X2.1/X2.2
    DeviceNet ..... 5-201
Cable X3 SER1 RS232
    ABB CS31 ..... 5-97
    ABB T200 ..... 5-108
    AEG A120 and A250 ..... 5-122
    Allen Bradley SLC 500-5/03 ..... 5-131
    Bus node BK06 ..... 5-250, 5-261
    EBERLE PLS514 - K43 ..... 5-30
    Jetter ..... 5-290
    Moeller PS4-201 ..... 5-516
    OMRON Host-Link ..... 5-358
    OMRON NT-Link ..... 5-374
    Schleicher microLine ..... 5-391
    Schraml PLC FWM105 ..... 5-56, 5-70
    Schraml SPS FWM160 ..... 5-58, 5-72
    Siemens S5 CP523/525 ..... 5-20
    Siemens S7 MPI (HMI adapter) ..... 5-455
Cable X3 SER1 RS485
    ABB T200 ..... 5-110
    Allen Bradley PLC 5 ..... 5-133
    DIN Measurement Bus master/slave ..... 5-218
    Fanuc CMM311 ..... 5-228
    Fanuc Series 90 ..... 5-226
    Idec Micro3 ..... 5-236
    Mitsubishi FX ..... 5-298
    Mitsubishi FX0 ..... 5-300
    Mitsubishi MelsecA ..... 5-309
    Moeller PS306 ..... 5-496
    Moeller PS316/PS416 ..... 5-498
    OMRON NT-Link 2-Wire ..... 5-376
    OMRON NT-Link 4-Wire ..... 5-378
    Siemens S5 CP523/525 ..... 5-22
    Siemens S5 with Helmholz SAS523/525 5-24
    Siemens S5 with VIPA BGM79-43 ..... 5-26
    Siemens S7 PPI ..... 5-470
Cable X3 SER1 TTY / 20 mA
    Bosch PU ..... 5-144, 5-156
    EBERLE PLS514 - K43 ..... 5-28
    Siemens S5 CP524/525 and Helmholz SAS 523/525 ..... 5-18
    Siemens S5 PG ..... 5-435, 5-436
    Sinec L1 Master ..... 5-481

CAN ..... 5-161
Communication definition ..... 3-33
For all Changes ..... 3-35
PLC handshake ..... 3-33
With +, -, or Enter ..... 3-35
With Enter ..... 3-34
Compact Flash card ..... 3-90
Control codes ..... 3-118
7FC7 ..... 3-120
7FC8 ..... 3-120
7FC9 ..... 3-120
7FCA ..... 3-120
7FCB ..... 3-120
7FCC ..... 3-120
7FCD ..... 3-120
7FCE ..... 3-120
7FEx ..... 3-120
7FF2 ..... 3-121
7FF3 ..... 3-121
7FF4 ..... 3-121
7FF5 ..... 3-121
7FF6 ..... 3-121
7FF7 ..... 3-122
7FF8 ..... 3-122
7FF9 ..... 3-122
7FFA ..... 3-123
7FFB ..... 3-123
7FFC ..... 3-120, 3-123
7FFD ..... 3-123
7FFE ..... 3-124
7FFF ..... 3-124

## D

Data logger ..... 3-96
Default help mask ..... 3-39, 3-131
DeviceNet ..... 5-183
Explicit message ..... 5-183
Format ..... 5-197
Module /network status ..... 5-187
Object definitions ..... 5-191
Poll I/O connection ..... 5-186
DF1 ..... 5-125
DIN Measurement Bus master ..... 5-206
Documentation parameters ..... 3-180
Global settings ..... 3-180
Help mask ..... 3-181
Masks ..... 3-180
Messages ..... 3-182
Projects ..... 3-180
Recipes ..... 3-181
System messages ..... 3-182
Documentation value ..... 3-30
Download
Automatic ..... 3-183
Cable 25 pin ..... 3-185, 3-186
Cable 9 pin ..... 3-184
Project ..... 3-183

## F

Fanuc SNP ..... 5-221
FB200
Sinec L1 Master ..... 5-485
FB201
Sinec L1 Master ..... 5-485
FB202
Sinec L1 Master ..... 5-485
FB203
Sinec L1 Master ..... 5-485
Field type ..... 3-28
Cyclical ..... 3-29
Input ..... 3-28
Output ..... 3-28
Password ..... 3-29
Fields ..... 3-26
Message field ..... 3-26
Recipe field ..... 3-27
Table field ..... 3-27
Font ..... 3-38
Format ..... 3-29
Display leading zeros ..... 3-29
Field length ..... 3-29
Fractional digits ..... 3-30
Only positive ..... 3-29
Formatted output
Display leading zeros ..... 3-40
Field length ..... 3-40
Fractional digits ..... 3-40
Positive values only ..... 3-40
Frames for buttons ..... 3-101
Function Keys ..... 3-103
Function keys ..... 3-103

## H

Help mask ..... 3-9, 3-39
Help mask for input variable ..... 3-131
Help mask for message masks ..... 3-132
Help masks for masks ..... 3-131
Help system ..... 3-131

## I

Idec Micro3 ..... 5-231
Image
Mask number ..... 3-178
User mode switch ..... 3-178
Images ..... 3-98
Input syntax
Bosch BUEP19E ..... 5-154
Input/output masks ..... 3-9
Intended use ..... 1-2
INTERBUS MMICOM Interface 02, 10, 15, 23 .... 5-

241, ..... 5-251

J

Jetter ..... 5-281

L

Limits ..... 3-30
Lower limit ..... 3-41

M

Mask parameters
- Access level ..... 3-5
- Activate help mask ..... 3-6
- Automatic data release ..... 3-6
- Background color ..... 3-5
- Help mask ..... 3-6
- Mask number ..... 3-5
- Reset password ..... 3-6
- Variables management topdown ..... 3-6

Mask structure ..... 3-4
Masks ..... 3-4
Mitsubishi FX ..... 5-293
Mitsubishi MelsecA ..... 5-303
MMICOM ..... 5-313
- MMICOM profile ..... 5-314

O

OMRON Host-Link ..... 5-351
OMRON NT-Link ..... 5-361
Output variables ..... 3-39
- Cyclical ..... 3-39
- Formatted output ..... 3-40
- One-off ..... 3-39

P

Parallel outputs ..... 3-179
PCP structure ..... 5-253
Physical interfacing
- INTERBUS Siemens S7 Functions ..... 5-259

Pin assignment
- INTERBUS ..... 5-320
- PROFIBUS ..... 5-402

Polling area
- Size ..... 3-118

Polling time ..... 3-117
Print logs ..... 3-89, 3-133
- Escape sequences ..... 3-133

ProComm plus ..... 5-387
PROFIBUS-DP ..... 5-395
- Data profile ..... 5-395

Protocol parameters
- Bosch BUEP19E ..... 5-151

R

Real-time clock
- Setting ..... 3-130

Recipe
- Structure ..... 3-166
- Working with ..... 3-166

Recipes ..... 3-163
Representation type ..... 3-11
- Alphanumeric ..... 3-17
- Bars ..... 3-23
- Binary number ..... 3-22
- Counter ..... 3-15
  - BCD format ..... 3-16
- Curve ..... 3-25
- Decimal number ..... 3-11
- Floating point number ..... 3-20
- Hexadecimal number ..... 3-21
- Selection image ..... 3-19
- Selection text ..... 3-18
- Standard ..... 3-11
- Timer ..... 3-12

S

Safety notes ..... 1-2
Scaled input ..... 3-31
Scaled output ..... 3-31
Scaling ..... 3-31
- Addend ..... 3-31
- Divisor ..... 3-31
- Factor ..... 3-31

Screen saver ..... 3-179
Set of curves ..... 3-92, 3-96
- Data logger ..... 3-96

Setting the operating mode ..... 3-1
Siemens S5 PG (AS511) ..... 5-427
Siemens S7 MPI ..... 5-439
Siemens S7 MPI (HMI adapter) ..... 5-449
Siemens S7 PPI ..... 5-463
Simulation without a controller ..... 3-187
Sinec L1 Master ..... 5-475
Softkeys ..... 3-103, 3-104
Standard Mode ..... 3-1
SUCOM1 PS306/316 ..... 5-491
SUCOM1 PS4-201 ..... 5-511
SUCOnet K ..... 5-519
Symbols ..... 3-98
- General ..... 1-1
- Specific ..... 1-1

System masks ..... 3-6
System parameter
- Polling area ..... 3-135

System parameters 3-134, 5-54, 5-67, 5-86, 5-94, ...5-104, 5-173, 5-287, 5-316, 5-348, 5-355, .5-370, 5-382, 5-388, 5-400, 5-443, 5-452, ..... 5-468
- Communication SER2 ..... 3-139
- Data set transfer ..... 3-140
- Gateway ..... 3-140
- General parameters ..... 3-134
- Message system ..... 3-137
- Parallel outputs ..... 3-140
- Password management ..... 3-139
- Print logs ..... 3-141
- Running time meters ..... 3-136
- Terminal clock ..... 3-136

Touch Parameters ..... 3-141
Variant options ..... 3-138
System variables ..... 3-41
Basic functions ..... 3-42
Communication SER1 ..... 3-47
Communication SER2 ..... 3-51
Editors ..... 3-86
Help ..... 3-87
Loadable character set ..... 3-83
Loop-through operation ..... 3-83
Maintenance ..... 3-84
Menu control / keys ..... 3-65
Parallel message system ..... 3-61
Password ..... 3-73
Printer control ..... 3-64
Real-time clock ..... 3-53
Recipes ..... 3-76
Running time meters ..... 3-81
Serial message system ..... 3-56
Sound ..... 3-93


## T


Target Group ..... 1-2
Transparent mode ..... 4-1
Error messages ..... 4-12


## U


Upper limit ..... 3-41
User mode switch
Demo mode ..... 3-2
Standard mode ..... 3-1
Transparent mode ..... 4-1, 4-2


## V


Value too large ..... 3-41
Value too small ..... 3-41
Variable type ..... 3-36
Variables ..... 3-10, 5-383
ASCII ..... 3-10
Bit ..... 3-10
Byte ..... 3-10
DeviceNet ..... 5-190
LWord ..... 3-10
Word ..... 3-10
Version number ..... 3-178

Sütron electronic GmbH
Kurze Straße 29
D-70794 Filderstadt
Phone: 0049 711 / 77098-0
Fax: 0049 711 / 77098-60
E-mail: doku@suetron.de
Internet: www.suetron.com

SÜTRON
ELECTRONIC GMBH